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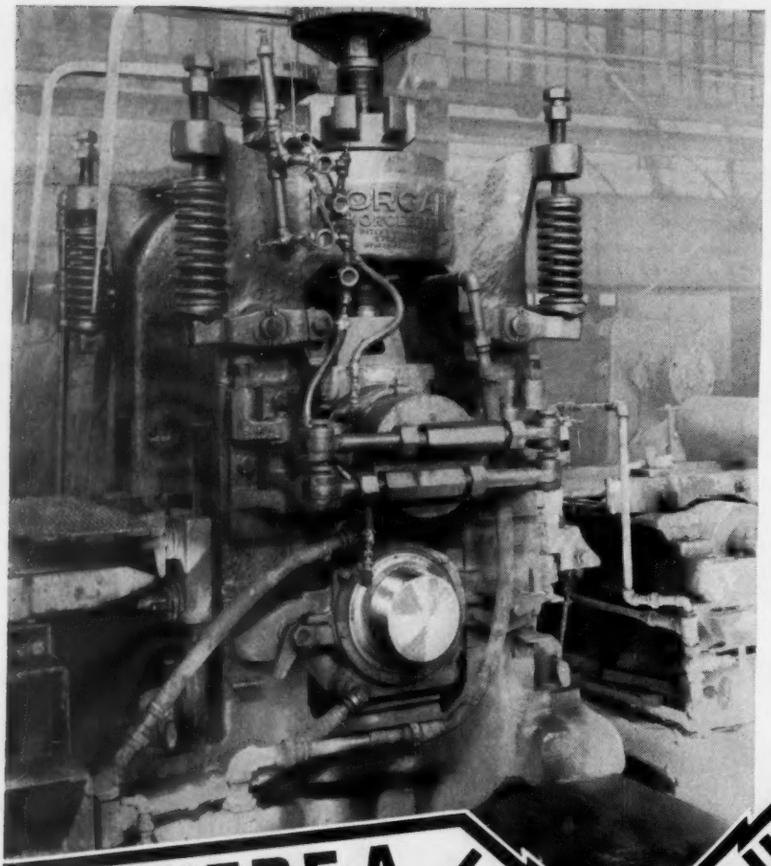

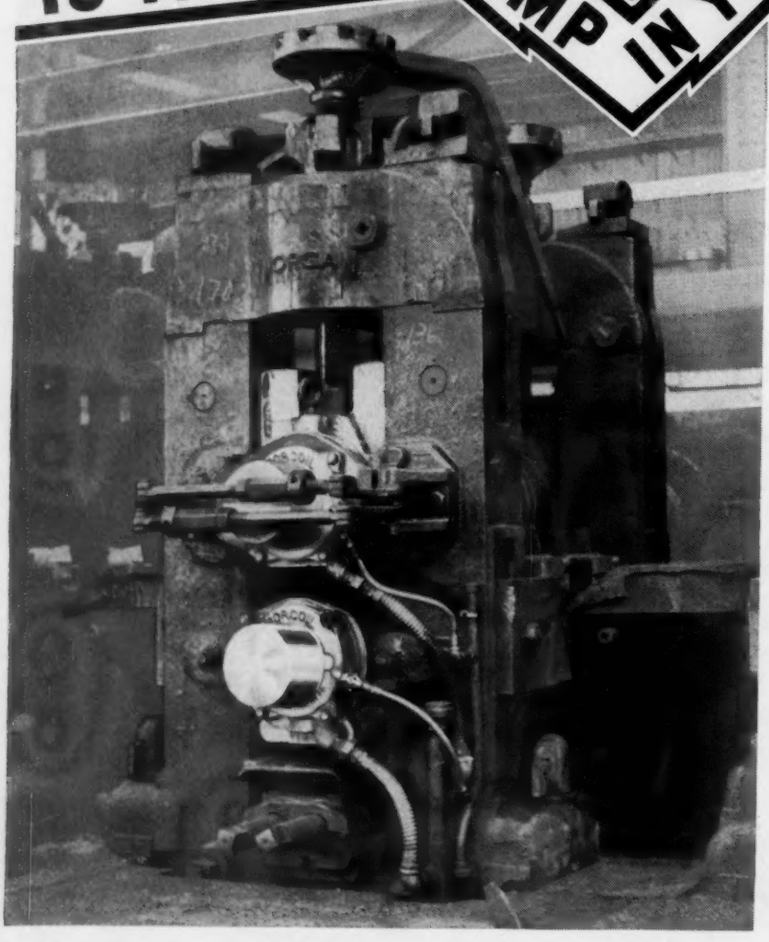

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As the Editor Views the News

■ CONSUMERS are suggesting (p. 15) that the steel industry might avoid extreme fluctuations in production and employment by carrying floating inventories of standard items to offset irregularities in demand. Advantages of further standardization, and making new prices effective immediately on announcement, also are discussed. Producers point out that enormous inventories would have to be carried, ask consumers to anticipate requirements. . . . STEEL'S thirteenth annual financial analysis (p. 34) shows a $10,936,841 net loss for 92.5 per cent of the industry in 1938. Total earnings were not enough to pay bond interest, and were less than one-fourth the industry's tax bill. . . . United States Steel Corp.'s management (p. 32) is hopeful for the immediate outlook. A stockholder suggests collective bargaining for shareholders as well as steelworkers.

• • •

Railroads' Burden

Of every dollar railroads take in (p. 33) 9 cents are paid for taxes, 23½ cents for maintaining roadway. Of every dollar taken in by motor carriers 4½ cents go for taxes, including gasoline tax and license fees, nothing for roadways. Inland water carriers pay only 2 cents for taxes, nothing for channels. . . . Aircraft industry's $200,000,000 backlog (p. 27) is a new peak. Since Jan. 1 bookings have totaled $95,000,000. Production for 1939 now is estimated at $225,000,000, 32 per cent higher than last year. . . . Foundrymen at eastern meeting (p. 20) were urged to work more aggressively for business now passing to other fabricating methods, and to establish closer relationship between producers and users of castings.

• • •

Pure Iron Powder

A vast amount of research in recent years has been devoted to pure iron sponge or powder. A number of important uses for iron powder now are proposed. STEEL (p. 43) reviews progress in this field to date. . . . Security and exchange commission (p. 26) has begun a study of the factors that prevent small business from obtaining capital. A house bill would authorize the department of commerce to spend $2,000,000 in business research. . . . Tennessee Coal, Iron & Railroad Co. (p. 26) will expand production of special shapes for use in prefabricated steel houses. Youngstown Sheet & Tube Co. (p. 75) is one of the sponsors of a new low-cost house of alloy steel construction. . . . Steel production (p. 19) again dropped 1 point last week to 53½ per cent of ingot capacity.

• • •

New Items, More Jobs

"New products and the training of workers to make them will solve the problem of unemployment." That is the belief of this week's contributor to STEEL'S Forum on Re-Employment (p. 38), Charles H. Oppenheimer, president, Designers for Industry Inc. He cites numerous companies which have increased employment through new products. . . . Sales appeal of nameplates and many other metal parts (p. 40) is increased through decorative treatment of wide variety. . . . Cold rolling facilities at the Irvin works (p. 56) have capacity for strip ¼-inch thick and lighter, up to 77 inches wide, in coils to 54-inch outside diameter, or in sheets to 32 feet long. . . . Recent research work (p. 74) reveals a wide range of cases that may be had by compounding gases in dry cyaniding.

• • •

96,200-Pound Pot Chuck

A fractional-horsepower motor plant (p. 62) is characterized by a unique materials handling system and by other features which promote manufacturing efficiency. . . . An unusual welded pot chuck weighs 96,200 pounds and is 33 feet 7 inches in outside diameter: it will slot teeth (p. 65) of forged internal gears which rotate 16-inch gun turrets on battleships. . . . Comprehensive tests (p. 70) show that the eye often is unreliable in choosing colors for large painted surfaces which are likely to affect illumination. Many times it is possible to select equally pleasing colors with a 10 to 15 per cent gain in reflecting value. . . . Interesting procedure has been developed at one plant (p. 66) in forming torpedo-type headlight shells of ultra-streamlined design.

E C Kreutzberg

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You can depend on better results in less time when your heat treater is guided by the Ryerson alloy data charts. These charts show him the exact properties of the steel with which he is working and show him how to get the desired results. He does not have to test. He takes no chances. Spoilage is eliminated and a sound dependable job of high accuracy and uniformity is assured.

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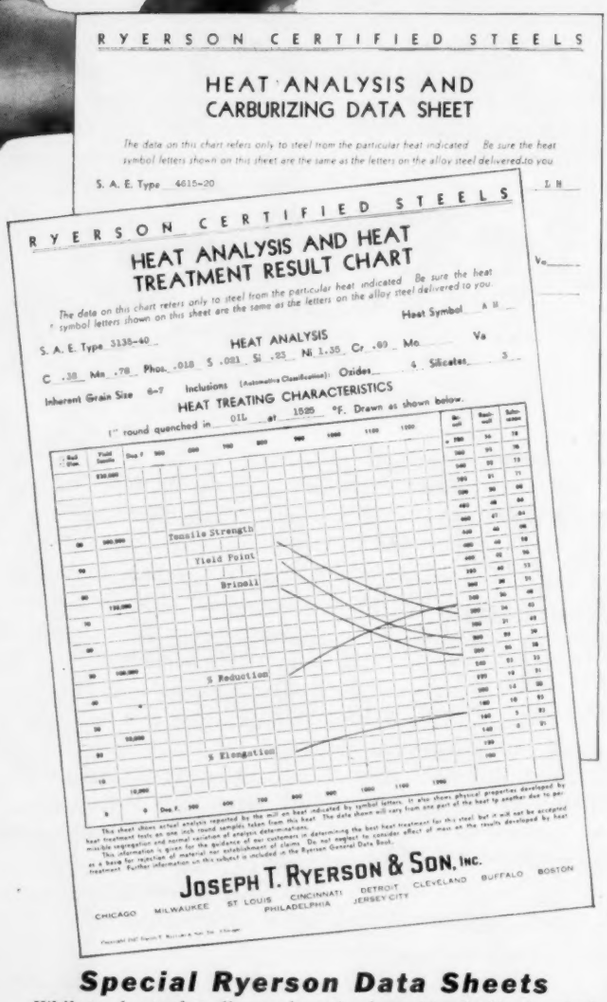
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HEAT ANALYSIS AND CARBURIZING DATA SHEET

The data on this chart refers only to steel from the particular heat indicated. Be sure the heat symbol letters shown on this sheet are the same as the letters on the alloy steel delivered to you.

S. A. E. Type 4615-20

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HEAT ANALYSIS AND HEAT TREATMENT RESULT CHART

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Heat Symbol

S. A. E. Type 3138-40 HEAT ANALYSIS

C .38 Mn .78 Phos. .018 S .021 Si .23 Ni 1.35 Cr .69 Mo Va

Inherent Grain Size 6-7 Inclusions (Automatics Classification): Oxides 4 Silicates 3

HEAT TREATING CHARACTERISTICS

1" round quenched in OIL at 1525 °F. Drawn as shown below.

Tensile Strength

Yield Point

Brinell

% Reduction

% Elongation

This sheet shows actual analysis reported by the mill on heat indicated by symbol letters. It also shows physical properties developed by heat treatment tests on one inch round samples taken from this heat. The data shown will vary from one part of the heat to another due to permissible segregation and normal variation of energy determinations.

This information is given for the guidance of our customers in determining the best heat treatment for this steel but it will not be accepted as a basis for rejection of material nor establishment of claims. Do not neglect to consider effect of mass on the results developed by heat treatment. Further information on this subject is included in the Ryerson General Data Book.

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While two heats of an alloy steel may be almost identical in chemical analysis, one may be much more responsive to heat treatment. For this reason, Ryerson data sheets show *actual* heat treatment results.

Two types of data sheets are used, one for the carburizing steels which gives complete analysis and the results of carburizing tests. The other, which is for the higher carbon steels, shows actual quenching and drawing results. Both charts are accurate guides that help the heat treater save time in securing desired properties.

RYERSON *Certified* STEELS

Stabilizing Production; Steel Grapples with Major Problem

■ CAN the steel industry level out employment? This is a question which is receiving increasing attention from its management and also has generated considerable thought on the part of the consuming industries.

The principal objective is the elimination or smoothing out of the cyclic business curve to the end that general purchasing power will be more uniform as the result of uniform employment and compensation.

A secondary objective is to place the industry in the best possible position with reference to the tax burden set up in the state unemployment compensation laws.

That business generally is recognizing the changing social order is evidenced by a statement of an official of the National Association of Manufacturers who recently urged business men to adapt and maintain practices which would bring about social and political evolution in line with industrial evolution. Industry already has taken many of the steps to effect a more perfect social order, but by no means has traversed the entire route.

Recently it has been suggested by some consumers that the steel industry could prevent to a large extent the extreme gyrations in production and employment by carrying floating inventories of standard items which would tend to offset irregularities in demand.

The steel industry regularly produces approximately 1200 different analyses of steel, each fabricated in a varying number of forms, with the result that the number of specifications runs into thousands. However, consumers point out that a considerable portion of these specifications are produced in so-called standard shapes and analyses. Carbon bars represent a good example. Supposing a steel mill had 2000 customers for ¼-inch 0.20 to 0.30 carbon rounds and sold an average of 20,000 tons per year. Consumers declare that under present practices, the mill will accumulate or pigeon-hole orders for this specification until sufficient tonnage is on the books to warrant a rolling. In the meantime, the first customers on the list find it necessary to wait five or six weeks for delivery on material for which there is often a pressing need.

Advocate Advance Rollings

It is suggested by consumers that this setup be reversed. The mill knows that barring an unforeseen business collapse it is likely to sell at least a large portion of the 20,000 tons of ¼-inch rounds. If it has found that it can produce these bars most economically in lots of 1000 tons, it is proposed that it roll this tonnage in advance rather than wait for individual orders to pile up to this amount.

In this way, the consumer would not be inconvenienced and the steel could be rolled in periods of comparative slackness. This plan presented by consumers does not propose completely to level out steel industry employment, but merely to smooth off some of the peaks, since it would be folly to stock items ordered infrequently. It is pointed out that had the plan been followed in 1938, as an example, monthly average operating rates would not have fluctuated between a low of 28 per cent in June and a high of 62 per cent in October.

In 1938 the steel industry suffered from the reaction to the activity of 1936 and 1937, but it could be fairly well assured that sooner or later demand would pick up considerably. Had it turned out standard items for its floating inventory during the early part of the year at a rate of around 35 per cent of capacity, the October peak might have leveled off to around 45 per cent.

Now as to consumer views regarding the extreme peaks in production which occur following announcement of a price advance: It is pointed out that in the spring of 1937, for instance, steelmaking topped the 90 per cent mark as the result of an announcement of higher prices. Subsequently operations dropped to 25 per cent.

It is felt that this could have been prevented by building up its floating inventories to a fairly high level prior to the advance which would have meant less strain on production to make deliveries. The subsequent decline in steelmaking activi-

ty in 1937 could have been made less precipitous by again replenishing inventories depleted by the unusual demand which accompanied the price advance.

It also is suggested that producers could help to avoid artificial bulges and declines in production by making effective dates of price advances simultaneous with announcements of such advances, instead of allowing weeks or months to intervene as at present.

A number of leading steel purchasers think the plan offers other definite advantages. If the mills maintain floating inventories of standard items, they can offer improved deliveries on specialty items which must be produced to order and often in relatively small quantities. A more even operation is likely to result in lower costs because of diminished strain on men and equipment, along with production of more economical "unit" tonnages.

Of course, consumers admit that the steel industry cannot fully stabilize employment itself since it is subject to the whims of consumers. But, among some consumers there is a tendency to standardize on analyses. For instance, a consumer of alloy bars has found he can use one in place of the previous four.

Rail Mills Handicapped

Standardization is one answer to the problem. A leading steel company executive points out that the railroads, as an example, have widely varying specifications for rails. Some roads even specify different rails for their several divisions. This means that rail mills cannot roll ahead in anticipation of railroads' requirements, but must wait until the actual orders are on the books.

Tin plate represents another example to which the principle of standardization might be applied and which might be produced ahead in anticipation of consumer requirements. While some variation in plate is necessary, depending upon the product packed, it is felt that many of the present varying requirements in finish and physical requirements are superfluous.

Many industries must adjust their buying practices to a more co-operative basis before the steel industry can effect desired adjustments in its operating schedules. This especially applies to the consumer goods industries, such as automotive. The latter often places large tonnages ranging from 25,000 to 100,000 tons, but no mill has the assurance that it will get part of the business. When the order finally is distributed delivery is requested for "the day after tomorrow." All this results in bulges in production which many in the steel trade feel could be avoided were the automobile industry to revise its steel buying policies in line with assembly schedules, adjusted in easy stages to conform to consumer requirements.

The automobile industry is typical of the increasing problems presented by the consumer goods industries whose requirements vary seasonally. An examination of steel production statistics reveals that seasonal variations have been more strongly accentuated in the past

Details of Steel Employment, Hours, Wages Since 1933

	Employes receiving hourly, piecework or tonnage wages						
1933	Number employes	Total hours worked	Average hrs. per week per employe	Total wages (dollars)	Average earnings per hr. (cts.)	Total wage, salary employes	Total payrolls (dollars)
June	305,239	51,645,321	39.4	24,441,054	47.3	338,146	30,560,761
Sept.	380,271	52,252,033	32.0	29,608,107	56.7	417,020	37,322,250
Oct.	378,862	52,308,897	31.2	30,291,985	57.9	416,277	38,334,978
Nov.	362,206	43,044,055	27.8	24,838,494	57.7	399,569	32,671,936
Dec.	357,424	45,736,252	28.9	26,439,830	57.8	394,943	34,323,694
1934							
Jan.	355,292	45,898,885	29.2	26,737,393	58.3	393,013	34,877,542
Feb.	365,305	46,655,614	31.9	27,394,221	58.7	403,298	35,424,791
March	380,471	56,047,913	33.3	33,010,060	58.9	419,277	41,263,370
April	392,069	56,723,813	33.7	36,778,026	64.8	431,086	45,471,878
May	409,698	66,450,593	36.6	42,916,172	64.6	449,362	51,895,931
June	415,547	63,589,289	35.7	40,630,314	63.9	455,966	49,466,644
July	383,673	41,381,779	24.4	26,150,272	63.2	424,126	34,913,521
Aug.	364,583	40,447,674	25.0	25,691,520	63.5	404,793	34,362,208
Sept.	343,064	33,203,234	22.6	21,244,286	64.0	381,828	29,142,892
Oct.	342,772	38,621,836	25.4	24,699,063	64.0	381,431	32,723,909
Nov.	343,219	38,793,790	26.3	25,082,162	64.7	381,663	32,937,099
Dec.	347,872	42,137,923	27.4	27,410,206	65.0	386,345	35,362,732
Total	369,845	569,093,876	29.5	357,293,012	62.8	409,349	457,842,517
1935							
Jan.	368,095	54,783,373	33.6	35,879,072	65.5	407,071	44,328,552
Feb.	381,010	54,221,180	35.6	35,652,577	65.8	420,397	44,212,859
March	385,506	57,882,810	33.9	38,053,190	65.7	425,189	46,764,185
April	384,546	56,368,953	34.2	37,174,010	65.9	424,623	45,890,244
May	381,303	57,326,908	33.9	37,529,522	65.5	421,470	46,493,536
June	376,431	50,777,987	31.4	33,080,422	65.1	416,732	41,902,874
July	375,348	52,309,007	31.5	33,855,040	64.7	415,937	42,725,150
Aug.	383,090	59,405,552	35.0	38,842,086	65.4	423,925	47,890,277
Sept.	387,924	56,485,479	34.0	36,863,891	65.3	429,217	45,892,839
Oct.	395,222	64,504,137	36.8	42,190,687	65.4	436,554	51,456,368
Nov.	396,949	60,819,820	35.7	40,027,160	65.8	438,370	49,170,940
Dec.	408,510	63,095,080	35.0	41,383,845	65.6	451,810	51,065,900
Total	385,328	687,979,926	34.2	450,531,502	65.5	425,941	557,793,724
1936							
Jan.	410,613	67,323,251	37.0	43,924,635	65.2	453,964	53,783,156
Feb.	408,976	62,310,069	36.8	40,496 550	65.0	452,649	50,249,537
March	413,645	67,850,000	37.2	44,477,510	65.6	458,070	54,399,880
April	434 594	76,244,541	40.9	49,911,816	65.5	480,119	60,150,807
May	455,765	79,890,221	40.5	52,291,495	65.5	491,864	62,757,288
June	451,299	78,989,190	40.8	52,522 262	66.5	498,243	62,990.808
July	467,065	80,526,023	39.0	53,823,890	66.8	514,742	64,497,877
Aug.	472 851	83,111,766	39.7	55,204,695	66.4	522,369	66,338,141
Sept.	476,593	82,656,665	40.5	54,480,950	65.9	526,717	65,611,223
Oct.	480,790	90,604,687	42.5	59,650 455	65.8	531,358	71,110,193
Nov.	478,108	83,473,936	40.7	57,652,243	69.1	529,208	69,286,257
Dec.	485,236	89,066,999	41.5	64,439,010	72.3	537,147	76,884,375
Total	452,128	942,047,348	39.8	628,875,511	66.8	499,704	758,059,542
1937							
Jan.	495,559	88,905,739	40.5	64.031,845	72.0	547,997	76 423,054
Feb.	502,688	85,502,314	42.5	61,765,546	72.2	556,077	74,277,665
March	520,487	98,100,014	42.5	77,278,240	78.8	577,050	90.863,016
April	530,098	93,979,207	41.3	79,885,171	85.0	589.351	94,321,859
May	533,550	91,194,218	38.6	78,382,248	86.0	595,354	92,941,305
June	495,260	83.391,779	39.2	72,582,963	87.0	555,743	87,519,613
July	532,694	87,769,974	37.3	75,661,847	86.2	593,906	90,549,660
Aug.	541,004	90,810,261	37.9	77,570.340	85.4	603 106	92,663.389
Sept.	540,389	85,011,778	36.8	71,140,268	83.7	602,729	86,160,875
Oct.	524,837	74 271,018	31.9	61,242,513	82.5	586,644	76,191,149
Nov.	490,238	57,939,478	27.6	47,213,654	81.5	551,158	62,119,455
Dec.	448,504	46,472,266	23.4	37,966,458	81.7	507.814	52,062,129
Total	512,942	983,348,046	36.8	804,721,093	81.8	572,244	976,083,169
1938							
Jan.	416,241	42,209,263	22.9	33.974.000	80.5	474.759	47.578,375
Feb.	402,750	40,128,200	24.9	32,618,070	81.3	460,617	45,599,050
March	397,538	47,057,185	26.7	38,499,749	81.8	454 997	51,386,004
April	387,650	42,490,753	25.6	35,096,911	82.6	444,781	47,809,421
May	378,680	40.907,993	24.4	34,189,756	83.6	435,589	46,756,699
June	368,239	40,380,352	25.6	34,125,126	84.5	424,703	46,705,739
July	368,003	39,446,563	24.3	33,442,475	84.8	424.354	45,802,450
Aug.	371,030	48,362,994	29.4	40,226,308	83.2	426,892	52,711,993
Sept.	375,400	48.271,926	30.0	40,054,206	83.0	430,882	52,364,808
Oct.	380,652	52,620,518	31.2	43,766,299	83.2	435,929	56,176,206
Nov.	394,832	57,884,241	34.2	48,357,224	83.5	450.244	61,053,955
Dec.	393,541	55,717,003	32.0	46,503,822	83.5	449,122	59,254,287
Total	386,213	555,476,991	27.6	460,853,946	83.0	442,739	613,198,987
1939							
Jan.	394,312	55,975,873	32.0	46,238,606	82.6	450,606	59,348,052
Feb.	396,495	53,109,307	33.5	43,897,977	82.7	452,872	57,044,172

Figures from American Iron and Steel institute.

eight or ten years and are apparently due to the rapid rise of consumer outlets, which in addition to automobiles include containers, refrigerators and thousands of light metal specialty products.

This has been coupled with a growing inclination on the part of many buyers to place orders only on a hand-to-mouth basis which means that steel required for peak production periods, usually spring and fall, is bought during those periods rather than in between when deliveries and service are better. This situation is accentuated at the time of a price rise when consumers scramble to cover on requirements.

Cites Major Difficulties

An executive of one important steel company analyzes the problem as follows:

"No one would dispute the benefits to public, employes and steel companies that would follow the leveling out of the steel production curve, but in an attempt to bring about this condition by operating steel plants at a uniform rate to be determined in advance, and filling peak demands from inventories accumulated during periods when demand is slack, two chief difficulties appear.

"1. The establishing of a production level to be maintained for a long period would necessitate long-range prediction of steel requirements. In times like the present it would take considerable courage to predict demand for a year ahead, determine the rate of operation needed to meet that anticipated total demand, and then adopt an operating rate based on that prediction.

"2. Enormous inventories would be needed, involving very heavy added cost for steel producers. The fact that demands are constantly shifting, plus the fact that there are nearly an infinite number of possible variations in steel products today—variations in both size and in analysis—would call for very large stocks, if orders were to be filled from materials on hand. The growing tendency toward 'tailor-made steels' is a major complicating factor in the inventory phase of the problem.

"One first practical step that would help to level out production would be for customers to anticipate their requirements as far as possible. Take the buyer who buys about 25 tons of a certain type of steel four times a year, and has to wait four or five weeks for delivery. If only he could anticipate his needs —and very possibly he could, as his requirements for this steel recur so uniformly—he would avoid the inconvenience he now suffers through delay, and the problem of the mill would be to that extent simplified."

That the steel industry already has made progress in partially leveling the peaks in employment may be readily seen by referring to the accompanying chart. It will be noted that the sharp swings in steel production are not closely accompanied by the trend in number of workers employed. The payroll trend is more closely in line, but even so does not fluctuate closely with production.

The tendency of the steel industry to absorb higher labor costs during periods of slow business dates back to the beginning of the depression when the share-the-work movement, which preceded NRA, gave at least a partial income to the bulk of the steel workers, in contrast to the previous practice of wholesale layoffs. This plan gave some employment to 75,000 employes of one large steel company, who otherwise would not have been employed.

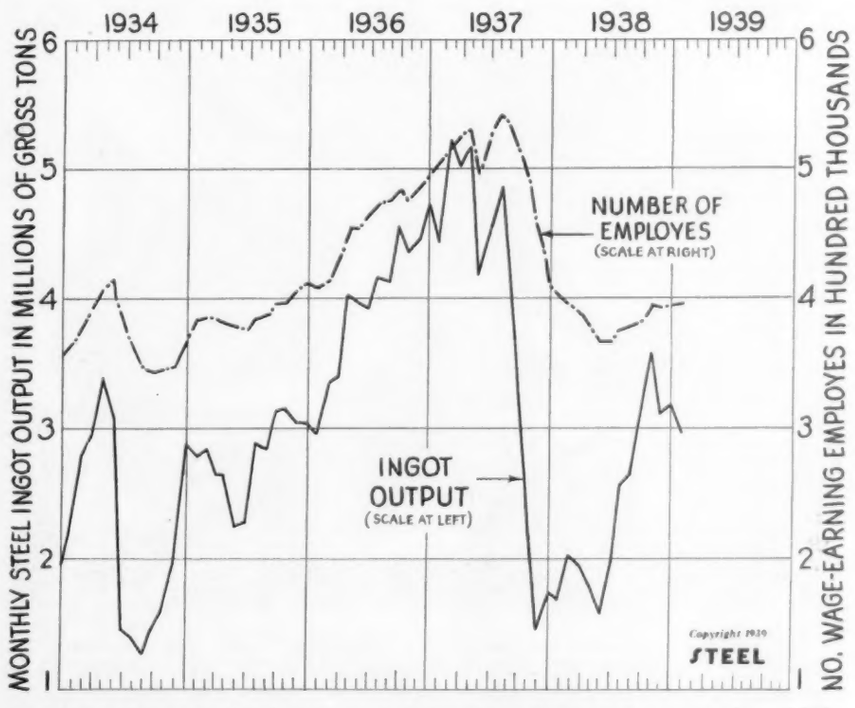
Wages at Record High

The move to share available work as much as possible has been accompanied by a sharp increase in wage rates. At the turn of the century the rate for common labor was 12 to 15 cents an hour, but today the base is at an all-time high of 62½ cents. This is due to the present highly-mechanized state of the industry which means that it requires a large amount of skilled labor and comparatively little unskilled labor.

"Sooner or later the steel industry will find it necessary to level out employment, either because of legislation or otherwise, but the industry cannot work out any plan without the wholehearted co-operation of the consuming industries," said a steel executive.

"The industry can and does build up inventories of certain standard items in slack times, but it cannot stock most other products."

Ups and Downs in Output, Employment



■ **Steel ingot production has fluctuated sharply in the past five years, from 1,268,977 gross tons in September, 1934, to 5,218,326 tons in March, 1937. Variations in number of wage earners employed have been, by comparison, less severe**

Republic Steel To Modernize Berger Plant

■ An extensive modernization and equipment re-arrangement program which will completely revamp production facilities is being started at Republic Steel Corp.'s Berger manufacturing division, Canton, O.

Installation of new presses, conveyor oven equipment, new conveyor lines and new air conditioned rooms for painting will result in an improved flow of material and quality.

The modernization program has been made necessary in part by increase in demand for new products, including library equipment.

Industry Substantially Mobilized For Emergency, Says War Secretary

■ INDUSTRY'S co-operation in the national defense program received warm praise from Col. Louis Johnson, acting secretary of war, speaking before a dinner of the American Conference on National Defense in New York, April 5.

Colonel Johnson told the 1200 attending that industry now is substantially mobilized for a possible war emergency. Supplies of raw materials required from foreign sources have been or are being accumulated.

"We depend," he said, "on foreign sources for 99 per cent of our chromium, 95 per cent of our high grade manganese, 50 per cent of our tungsten, 95 per cent of our rubber, and practically all of our tin."

While the war department has urged stockpiles of these strategic materials for years, it was not until the Munich conference that the acute need for such materials became generally apparent. The war department lacked funds to acquire the stockpiles, turned to industry for help.

"We called a conference of those who used chromium and explained the situation. Immediately, they responded. One corporation, to my knowledge, went out into the open market and bought enough chromium to tide over its need for a period of three years.

"We told a group of industrialists of the likely shortage of manganese and the greatest American producers of ferromanganese began to build up their stocks.

"When we informed industry of our needs in tungsten, it intensified the development and the production of this mineral in our own country and added considerably to our annual output.

Developing Rubber Substitute

"When we pointed out our needs in rubber, industry intensified its efforts, at great expense, toward the production of a substitute. I am sure you will all be interested to learn that there is every indication of success in this significant experiment.

"When we advised industry of our requirements in tin, it lent its energy toward the development of a nickel plated can which today gives every promise of replacing tin for all purposes and at no greater cost."

Since September, when the power industry was asked to start construction of at least 1,000,000 kilowatts of additional capacity, 900,000 kilowatts have been installed or are in order, Colonel Johnson said.

The nation now has sufficient supplies on hand to carry an initial army of 400,000 through the first six months. During such a 6-month period, the colonel said, industry as now organized could start mass production of all but 55 of the 7000 items needed by the war department in an emergency. Educational orders soon will be placed to take some of the 55 items off the "not available" list.

Rear Admiral Clark H. Woodward and Col. Frederick H. Payne, vice chairman, American Conference on National Defense, were other speakers at the dinner.

Incidental to the preparedness dinner, the Wire association held a regional meeting in New York, April 5, inspecting the signal section, army base, Brooklyn. Most members attended the national defense dinner.

SCRAP INSTITUTE OFFERS GOVERNMENT CO-OPERATION

WASHINGTON

Institute of Scrap Iron and Steel's war service committee met here last Friday to initiate a program to tie the industry's facilities in with the army and navy's industrial mobilization plan.

Although scrap iron and steel are not included in the list of strategic and critical materials, of which the government is proposing to accumulate stocks, the industry is preparing to co-operate to assure an adequate supply.

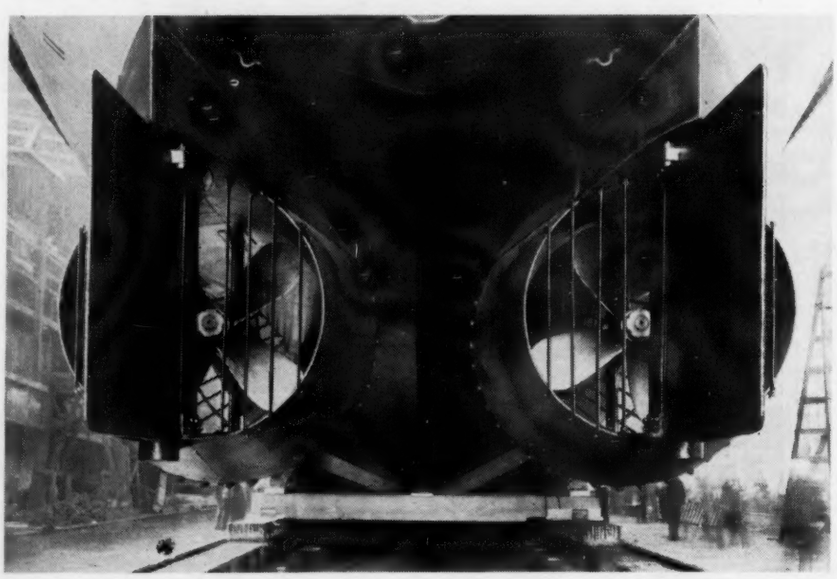
Survey of available stocks and complete analysis of steel mill and foundry scrap requirements will be undertaken promptly by the institute's war service committee in conjunction with the presidents of its 19 chapters.

"Present visible supplies and reserves of scrap are ample to take up any sudden strain occasioned by a possible sharp rise in the rate of steel production in event of an emergency," said E. C. Barringer, institute's executive secretary. "Meanwhile, an increase in the consumption of steel would automatically expand the production of scrap and augment the present visible supply."

The committee also conferred with the planning branch of the army and navy munitions board.

■ Orders received by General Electric Co. in the first quarter amounted to $86,882,953, compared with $65,376,400 for the corresponding period in 1938, an increase of 33 per cent.

Welded Construction on Tug for Working in Ice



■ **Arc welding was used extensively by Canadian Vickers Ltd., Montreal, in constructing this towing tug, designed for working in ice. Kort nozzles were built integrally with the ship's hull around each propeller, giving effective protection. Incorporated in the nozzle structure are twin Oertz streamline rudders, arranged to permit convenient removal of propellers and tailshafts. Photo, courtesy Wilson Welder & Metals Co., New York**

Ingot Rate 55.6 Per Cent in March

■ STEEL ingot production in March totaled 3,364,877 gross tons, largest monthly output this year, and exceeding that of any month in 1938 except November, when 3,572,220 tons were made, according to the American Iron and Steel institute.

First quarter output amounted to 9,506,594 tons, 75 per cent more than in the first quarter of 1938, and only 3 per cent less than in the fourth quarter last year.

March operating rate was 55.63 per cent of capacity, against 54.10 per cent in February and 33.85 per cent in March, 1938. First quarter operations averaged 54.14 per cent, compared with 55.77 per cent in fourth quarter and 31.58 per cent in first quarter last year.

Average weekly production was 759,566 tons in March, 738,721 tons in February and 454,268 tons in March, 1938. For first quarter this year the weekly average was 739,237 tons, compared with 748,350 tons for fourth quarter and 423,709 tons for first quarter last year.

District Steel Rates

Percentage of Ingot Capacity Engaged In Leading Districts

	Week ended April 8	Change	Same week 1938	Same week 1937
Pittsburgh	49	None	29	95
Chicago	53.5	None	31	84
Eastern Pa.	40	None	28	59.5
Youngstown	48	— 2	33	87
Wheeling	66	None	33	96
Cleveland	52.5	None	27	74
Buffalo	44.5	+ 2.5	28	88
Birmingham	62	None	66	80
New England	35	—15	20	95
Cincinnati	44	— 7	45	90
St. Louis	42	— 1	42.4	82
Detroit	69	— 5	18	100
Average	53.5	— 1	32	91.5

J & L Extends Inspection Of Seamless Drill Pipe

■ Jones & Laughlin Steel Corp., Pittsburgh, has adopted two procedures for inspecting its integral joint seamless drill pipe. They include the use of a new instrument called the Tube-wall-scope to examine interior surfaces. A new application of the Magnaflux method is being used on tube exteriors.

The Tube-wall-scope is an optical instrument which is pushed through the pipe. A strong light, reflectors and lenses enable the operator to see the interior highly magnified, and to locate defects. Every length of drill pipe is now subjected to the two tests in addition to the usual inspections.

■ With a backlog of orders totaling $925,000, mainly for jail equipment, Van Dorn Iron Works Co., Cleveland, will continue 100 per cent activity for at least six months.

Steel Ingot Statistics

Monthly Production—Complete for Bessemer; Open Hearth, Calculated from Reports of Companies Making 98.26 per cent in 1937

1939	—Open Hearth— Gross tons	Per cent of capacity	—Bessemer— Gross tons	Per cent of capacity	—Total— Gross tons	Per cent of capacity	Weekly production, all companies, gross tons	Number of weeks in month
Jan.	3,039,340	55.19	147,494	27.24	3,186,834	52.69	719,376	4.43
Feb.	2,758,697	55.48	196,186	40.12	2,954,883	54.10	738,721	4.00
March	3,170,183	57.56	194,694	35.95	3,364,877	55.63	759,566	4.43
3 mos.	8,968,220	56.10	538,374	34.25	9,506,594	54.14	739,237	12.86
1938								
Jan.	1,632,773	30.25	99,991	18.27	1,732,764	29.15	391,143	4.43
Feb.	1,578,233	32.38	125,493	25.40	1,703,726	31.74	425,931	4.00
March	1,854,669	34.36	157,737	28.83	2,012,406	33.85	454,268	4.43
3 mos.	5,065,675	32.33	383,221	24.13	5,448,896	31.58	423,709	12.86
April	1,793,522	34.31	131,644	24.84	1,925,166	33.44	448,757	4.29
May	1,676,215	31.06	130,590	23.87	1,806,805	30.39	407,857	4.43
June	1,519,589	29.07	118,688	22.40	1,638,277	28.46	381,883	4.29
July	1,854,076	34.43	127,982	23.44	1,982,058	33.42	448,429	4.42
Aug.	2,350,199	43 54	196,789	35.97	2,546,988	42.85	574,941	4.43
Sept.	2,449,861	46.98	207,887	39.32	2,657,748	46.28	620,969	4.28
Oct.	2,894,726	53.63	223,208	40.79	3,117,934	52.45	703,823	4.43
Nov.	3,370,974	64.50	201,246	37.98	3,572,220	62.05	832,685	4.29
Dec.	2,984,204	55.42	158,965	29.12	3,143,169	53.00	711,124	4.42
Total	25,959,041	40.86	1,880,220	29.20	27,839,261	39.79	533,933	52.14

Percentages of capacity operated for 1939 are calculated on weekly capacities of 1,243,153 gross tons open-hearth ingots and 122,248 gross tons bessemer ingots; total, 1,365,401 gross tons; based on annual capacities as of Dec. 31, 1938, as follows: Open-hearth ingots, 64,817,994 gross tons; bessemer ingots, 6,374,000 gross tons.

Percentages of capacity operated for 1938 are calculated on weekly capacities of 1,218,342 gross tons of open-hearth ingots and 123,514 gross tons of bessemer ingots, total 1,341,856 gross tons; based on annual capacities as of Dec. 31, 1937, as follows: Open-hearth ingots, 63,524,356 gross tons; bessemer ingots, 6,440,000 gross tons.

PRODUCTION

■ STEELWORKS operations last week declined 1 point to 53.5 per cent. Reductions were noted in five districts, an advance in one, and six were unchanged. A year ago the rate was 32 per cent, two years ago 91.5 per cent.

Youngstown, O.—Loss of 2 points to 48 per cent resulted from lower bessemer production, 42 open hearths continuing activity. Schedules for this week indicate further decline of 2 or 3 points.

Cleveland—All producers held operations steady, rate holding at 52.5 per cent for third consecutive week.

Chicago—Unchanged at 53.5 per cent, reduced activity by three producers balanced by increases by two others.

St. Louis—Declined 1 point to 42 per cent, with most plants at unchanged rate.

Cincinnati—Dropped 7 points to 44 per cent. Indications are for resumption of one or two open hearths this week.

Birmingham, Ala.—Steady at 62 per cent with 13 open hearths active.

Buffalo—Increased 2.5 points to 44.5 per cent, as Bethlehem lighted two additional open hearths at Lackawanna plant.

Pittsburgh—Held at 49 per cent, with indications for the same rate this week.

Wheeling—Continued at 66 per cent with the same rate probable for this week.

Detroit—Four open hearths were taken off at midweek, reducing the rate 5 points to 69 per cent, the lowest since September. On the present basis operations this week will be down 10 points more, to 59 per cent.

New England—Receded 15 points to 35 per cent, the lowest in more than a year.

Central eastern seaboard—Continued at 40 per cent, with no indication of immediate change.

Canadian Output Lower

■ Canada's production of steel ingots, castings and pig iron in February was less than in January, 1939, and February, 1938. Two months' output this year was below that of the corresponding period a year ago.

Gross Tons

	Steel ingots, castings	Pig iron	Ferro-alloys
Feb., 1939	77,179	41,333	5,299
Jan., 1939	78,198	57,660	2,855
Feb., 1938	98,980	61,000	4,436
Two months, 1939	155,377	98,993	5,154
Two months, 1938	211,360	136,309	9,933

Eastern Founders Discuss Problems; Producer-Consumer Unity Urged

■ DETERMINED effort is being made by the foundry industry to obtain its rightful share in steel and iron tonnage, Marshall Post, president, American Foundrymen's association, Chicago, told castings makers at a regional meeting at New Brunswick, N. J., April 1. As an example, he pointed out that castings now are being used by the automotive industry in ways not heretofore considered expedient.

The conference was the first sponsored by the Philadelphia and Metropolitan New York-New Jersey chapters, in co-operation with the mechanical engineering department, Rutgers university. It was promoted under direction of H. L. Henszey, Carborundum Co., Philadelphia, and Don Reese, International Nickel Co., Bayonne, N. J., heads of the Philadelphia and New York-New Jersey chapters, respectively. More than 200 attended.

Edwin C. Barringer, executive secretary, Institute of Scrap Iron and Steel Inc., New York, made the feature address at the dinner, which was presided over by Mr. Post. He said unfair implications have been read into the purchase of American pig iron, scrap, finished steel and rolling mill equipment by foreign nations.

"Metals of Peace"

"The assumption that these metals are entirely for war purposes is erroneous, because abroad, as at home, iron and steel, including castings, are inherently metals of peace and vehicles of a high standard of living."

He pointed out that the entire tonnage for the present American naval expansion program, which will take three and a half years to complete, could be rolled at the Gary, Ind., plant of Carnegie-Illinois Steel Corp. in a little more than one turn, if all plant facilities were concentrated on such an order. He contended that armaments in themselves, citing various examples, took a surprisingly small steel tonnage.

Discussing trends in scrap, he said the broadening range in alloy steels accentuates the scrap segregation problem, and the time is approaching when this will demand consideration by both seller and consumer. Due to increasing trend toward light consumer goods, potential scrap supply for foundries is diminishing, though he did not imply a marked shortage is imminent.

W. G. Reichert, Singer Mfg. Co., Elizabeth, N. J., addressing the technical session on "Castings Defects as Affected by Sand," suggested the importance of investigating and classifying the cause of all complaints, whether due to sand, metal, molding or gating arrangement, and of maintaining records of losses and correlating them with test data, with responsibility definitely centralized. Plotting curves of permeability, strength and moisture against scrap losses caused by sand, such as blows, drops, stickers, rough, and cuts, also proves valuable.

Molding Control Stressed

Sand with a suitable grain structure should be selected and used as a base for the variables, such as permeability, strength, and the fines which accumulate in the heap. Importance of moisture in controlling the gas content of the mold and in reducing blows was stressed.

Mr. Reichert stated a soft mold, resulting in an over-weight casting, swells, and strains, may be caused by increase in moisture or fineness of sand or decrease of strength. On the other hand, a hard mold under standard ramming conditions may be caused by increase in strength or decrease in moisture and fineness, and its most common defects are blows and scabs.

Deformation, according to the speaker, is important as a controlling factor in regulating the green sand crush and in preventing drops, if flasks or bars in the flask distort slightly under compression loads.

Slides illustrated effect of grain distribution and fine and coarse additions to a standard sand. Fine grains, it was indicated, often will cause a drop of 50 per cent in permeability and as much as 30 per cent coarse sand addition is necessary to cause permeability increase. It was evidenced by this and other effects that satisfactory grain structure and an open sand can be insured only by controlling the fines.

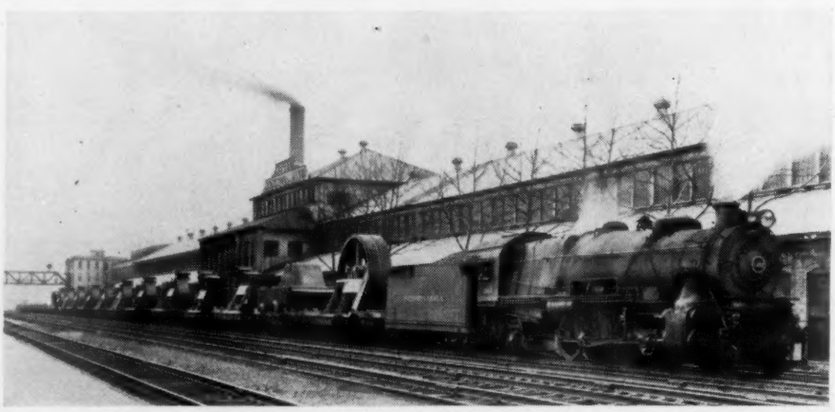
Practical methods were discussed for removing the fines, such as cyclone separation, air washing, exhausting by a fan and by sieving.

Mr. Reichert illustrated reaction of molding sands at elevated temperatures, particularly the effect of permeability, expansion and contraction. Decrease of permeability at elevated temperature, he said, is due to expansion of gases and to a lesser extent to gases from combustion of carbonaceous material in the sand. Expansion and contraction are important as far as they are definitely found to be the gateway to the cause and remedy for cracks, buckling, rat-tails and scabs. Slides illustrated these defects and demonstrated how conditions could be remedied by additions of molding materials.

He stated the best type of sand would give poor results unless gating design and position of runners

(*Please turn to Page* 84)

Mill Castings Thrown Overboard in Atlantic Gale



■ **Part of this trainload of rolling mill equipment, shown leaving the Homestead, Pa., plant of Mesta Machine Co., now lies on the bottom of the Atlantic. The equipment for John Summers & Sons Ltd., England, was shipped aboard the BELNOR at Baltimore recently. In mid-ocean the ship ran into a heavy storm and 125 tons of heavy castings which had shifted on the deck, causing a perilous list, were thrown overboard. The castings will be replaced and sent over with later consignments on the same order**

FINANCIAL

CLEVELAND-CLIFFS PROFIT REDUCED BY LEAN ORE YEAR

■ CLEVELAND-CLIFFS IRON CO., Cleveland, reports net profit for 1938 was $755,759, equal to $1.55 per preferred share, compared with $5,020,933, or $10.30 a preferred share in 1937. No dividends were declared on preferred stock in 1938. Arrearages on preferred stock were $28.16 a share at year's end.

Company reported 1938 was the second worst year since 1900 in volume. Ore shipments dropped 68.7 per cent from 1937, which was the second best year since 1900.

The management expressed its belief 1939 will be a better year both in volume and earnings than 1938, but far below 1937. Iron ore stocks at lower lake docks and furnaces will be approximately 12,000,000 tons less than last year at navigation season's opening, it was estimated.

Cliffs Corp., which owns all outstanding common shares of Cleveland-Cliffs Iron and other investments, shows income from dividends in 1938 of $261,254, against $837,875 in 1937. Directors declared a dividend of 10 cents payable April 15 to record of April 10.

NATIONAL STEEL FILES NEW ISSUE WITH SEC

National Steel Corp., Pittsburgh, has filed with the SEC a registration statement covering $65,000,000 of securities, including $50,000,000 first collateral mortgage bonds, due April 1, 1965, and $15,000,000 serial notes due April 1, 1940-1949. Proceeds will be applied as follows: $49,350,000 to redemption at 105 and interest of $47,000,000 of the 4 per cent series bonds; $9,917,000 to redemption at 105½ and interest of $9,400,000 of 3¾ per cent bonds. The balance plus treasury funds will be advanced to Great Lakes Steel Corp., Detroit, for discharge of a $5,000,000 expansion obligation. Principal underwriters are the Kuhn, Loeb & Co., Harriman, Ripley & Co. Inc., White, Weld & Co., and Lee Higginson Corp.

INLAND HOLDERS APPROVE WILSON & BENNETT PURCHASE

Inland Steel Co. stockholders have approved plan to acquire Wilson & Bennett Mfg. Co., Chicago, makers of steel drums, barrels and other containers, through exchange of 45,000 Inland shares for all issued Wilson & Bennett stock. Stockholders also approved issuance of 50,000 additional Inland shares no par stock.

♦

Arthur G. McKee & Co., Cleveland, report 1938 net profit was $612,770, highest on record. This was equal to $7.45 per share on B stock and compares with $401,876 or $4.89 per share, in 1937. Dividends paid in 1938 were $4 a share, against $3.75 in 1937. Four-fifths of new business in 1938 was from the petroleum refining industry; in 1937, two-thirds came from the iron and steel industry. Foreign contracts accounted for 90 per cent of new business; normally domestic contracts account for more than half the total.

♦

Woodward Iron Co., Woodward, Ala., reports net profit of $180,121, equal to 66 cents a share on capital stock, for first quarter. This compares with a net profit of $287,390, or $1.06 a share, in the March quarter last year.

MEETINGS

A.I.S.E. TO INSPECT COKE, BLAST FURNACE PLANT

■ DETROIT section, Association of Iron and Steel Engineers, will sponsor a national meeting April 19 to inspect the blast furnace and coke plant recently completed by Great Lakes Steel Corp. at Ecorse, Mich. An invitation has been extended to both the Eastern and the Western States Blast Furnace and Coke Oven associations.

In the evening a technical program will be presented in the Fort Shelby hotel, Detroit, for consideration of the following papers: "Design and Construction of the New Blast Furnaces at Great Lakes Steel Corp.," by Raymond M. Hughes, assistant chief engineer, and William J. Rees, mechanical engineer, Great Lakes Steel Corp.; "Design and Construction of the New Coke Plant at Great Lakes Steel Corp.," by Charles P. Betz, superintendent, coke plant, Hanna Furnace division, and Phillip C. Vetter, engineer, Great Lakes Steel Corp.

WAREHOUSE ASSOCIATION TO MEET IN CHICAGO, MAY 16-17

American Steel Warehouse Association Inc. will hold its thirtieth annual convention May 16-17 at the Drake hotel, Chicago. The first day will be devoted largely to conferences, with a business session at 2 o'clock. The annual business meeting will be at 10 o'clock the second day, with a further session in the afternoon and the annual banquet at 8.

NATIONAL METAL TRADES' FORTY-FIRST CONVENTION

National Metal Trades association will hold its forty-first annual convention at the Palmer House, Chicago, May 24-25. Industrial relations problems will be discussed.

Sales Promotion, Way to Profits

■ SALES promotion is one of the two means left by which business management can protect its slender but vital 4 per cent profit margin, declared J. H. Van Deventer, editor, *The Iron Age*, to Industrial Marketers of Cleveland, in that city, last Friday.

He pointed out control of taxes, wages and hours, overtime and material costs has been taken out of management's hands by government and labor unions. Remaining to management are only control of productivity per man hour and volume of business.

Mr. Van Deventer praised business for its handling of productivity per man hour. Management has not done so well with sales promotion, he said.

"I am sure you all know about the break-even point. It is the point at which a shrinkage in sales volume will dip you into the red and an increase in volume will turn the profit and loss figures black. It is a critical and significant point . . .

"That is the time your promotion efforts should be doubled and redoubled. That is the time when modern sales promotion, by increasing volume even a little, will pay big dividends in increased profits or decreased losses."

The speaker likened sales promotion to mechanized sales effort; personal selling to skilled handwork. Personal selling, he said, is limited as to expansion of effort, the good salesman now being loaded to top capacity.

"Promotional sales effort, like modern production machinery, is unlimited as to capacity. You can speed it up 10, 20, 100 or 1000 per cent over night."

Mr. Van Deventer was introduced to the group, numbering about 1000, by E. L. Shaner, editor-in-chief, STEEL.

Industrial Building Costs Below 25-Year Average

■ Industrial building costs during first quarter 1939 were 8 per cent below the 25-year average, according to a cost chart compiled by The Austin Co., Cleveland. Chart records the average cost per square foot of one-story daylight plant construction.

Current cost is $1.40 per square foot, compared to a 25-year average of $1.52. It compares with a record high of $2.67 in spring of 1921 and a depression low of $1.08 during the first half of 1933.

MEN OF INDUSTRY

■ C. I. AUTEN has been appointed manager of sales, cold formed steel division, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala. Mr. Auten will direct sales activity pertaining to the use of cold formed steel products in eight southeastern states, with emphasis upon materials for prefabricated steel houses and farm buildings. Since joining the company in March, 1938, Mr. Auten has been engaged in co-ordinating developments of steel for new purposes, and has directed its activities in co-operation with farm security administration engineers to develop prefabricated steel buildings recently erected by the company for the federal agency.

In 1936 Mr. Auten resigned as vice president, Truscon Steel Co., Youngstown, O., spending the ensuing two years in Orlando, Fla.

C. M. McKenna, a sales engineer, has been named assistant to Mr. Auten.

♦

D. V. Sawhill has been elected president, Mercer Tube & Mfg. Co., Sharon, Pa. He succeeds Henry Greenberg.

♦

Thomas E. Millsop, president and director, Weirton Steel Co., Weirton, W. Va., has been elected to a vice presidency of National Steel Corp., Pittsburgh, parent company.

♦

Ralph Hering has been appointed district manager of sales, Superior Steel Corp., Pittsburgh, with offices in the Mutual Home building, Dayton, O.

♦

Frank W. Curtis, formerly manager, Firthite division of Firth-Sterling Steel Co., McKeesport, Pa., is now chief engineer, Van Norman Machine Tool Co., Springfield, Mass.

♦

Charles R. Hook, president, American Rolling Mill Co., Middletown, O., will be honored at a dinner planned by civic leaders April 18 at Manchester hotel, Middletown. Reservations will be limited to 1300.

♦

John C. Chaffe, a member of Republic Steel Corp.'s Philadelphia district sales staff, has been appointed assistant district sales manager at Philadelphia. Formerly he was vice president, Wrought Iron Co. of America, Lebanon, Pa.

♦

G. S. Martin, director of purchases, American Bantam Car Co., Butler, Pa., has resigned. Prior to joining that organization he was assistant purchasing agent for a number of years at Willys-Overland Co., Toledo, O. For the present he is located at Elyria, O.

C. I. Auten

♦

Harry B. Holland is now associated with Strong Steel Foundry Co., Buffalo, as sales representative in the eastern district, with headquarters at 860 Prospect street, Roselle Park, N. J.

♦

A. C. Hanson has been appointed district representative and sales engineer in the Detroit territory for Foote Bros. Gear & Machine Corp., Chicago, replacing Everett G. Akridge. Mr. Hanson formerly covered the northern Indiana and southern Michigan area.

♦

Harold S. Falk, vice president and general manager, Falk Corp., Milwaukee; Donald J. Campbell, president, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., and James R. Allan, assistant manager of industrial engineering and construction, International Harvester Co., Chicago, have been chosen by the board of awards, American Foundrymen's association, Chicago, to receive gold medals, which will be presented at the association's annual convention in Cincinnati, May 15-18.

The John A. Penton gold medal is being given to Mr. Falk in recognition of his leadership in promoting interest in foundry apprentice training; the W. H. McFadden gold medal to Mr. Campbell as president of Campbell, Wyant & Cannon for outstanding accomplishments of this company in casting manufacturing processes; and the J. H. Whiting gold medal to Mr. Allan in recognition of his engineering contributions to the association and the foundry industry.

♦

Wyman Howells, formerly associated with the Reading Iron Co., Philadelphia, has joined the Houston, Tex., office of Allegheny Ludlum Steel Corp., Pittsburgh, as a salesman specializing in the sale of Allegheny Ludlum lap weld line pipe, effective April 15.

♦

David Dasso has resigned as vice president, American Locomotive Co., diesel engine division, New York. He will be retained in a consulting capacity and also will continue as United States representative of Sulzer Bros. Ltd., Winterthur, Switzerland.

♦

William Hume, formerly manager of sales, wire and wire products division, Pittsburgh Steel Co., Pittsburgh, has been named general manager of sales. Other promotions in the sales department are: J. Kennedy Beeson, heretofore assistant manager of sales, is now assistant general manager of sales; Henry A. Roemer Jr., Pittsburgh district sales manager, has become manager of sales, rod and wire products divi-

Harold S. Falk

D. J. Campbell

James R. Allan

sion; William M. Jensen, former Chicago district sales manager, has been made Pittsburgh district sales manager, succeeding Mr. Roemer, and Leon A. Mullen succeeds Mr. Jensen as Chicago district sales manager. Mr. Mullen formerly was assistant district sales manager at New York.

♦

Ralph B. Kraft has been appointed manager, roll sales department, Lewis Foundry & Machine division, Blaw-Knox Co., Pittsburgh. Mr. Kraft has been with the division in other capacities for some time, and has had considerable experience with the steel industry as a manufacturers' agent.

♦

A. G. Bussmann, manager, wire sales department, Wickwire Spencer Steel Co., New York, has been transferred to Buffalo, where in addition

A. G. Bussmann

to continuing as wire sales manager, he will direct all activities of that office.

A graduate of Carnegie Institute of Technology, he served as chemist for the New York public service commission and then for 14 years as chemist and welding engineer, American Steel & Wire Co., after which he joined Wickwire Spencer as wire and springs sales manager.

T. H. McSheehy, since 1931 Chicago district manager of Wickwire Spencer, has been placed in charge of the firm's hardware products department, in addition to his present duties. The department has been moved from New York to the Midwestern office at 221 North LaSalle street, Chicago. Prior to joining the Chicago sales office of Wickwire in 1924. Mr. McSheehy was identified with the American Steel & Wire Co. and Pennsylvania railroad.

♦

John M. Wilson, president, National Supply Co., Pittsburgh, has been made chairman of the board. J. A. Geismer, heretofore vice president and general manager, has been named president. A. E. Walker becomes vice president; C. A. Meyer, treasurer, and R. W. Eiler, secretary. Other vice presidents are: C. R. Barton, F. H. Green, and D. S. Falkner.

Ralph B. Kraft

♦

Otto Kafka Jr. has been elected president, Otto Kafka Inc., New York, exporter and importer of iron and steel products. He succeeds the late Otto Kafka. Robert Kafka has been named vice president. Herman Gaffron continues as secretary-treasurer.

♦

Charles Thiede, chief tool engineer, Jefferson plant of Chrysler Corp., has been elected chairman, Detroit chapter, American Society of Tool Engineers. S. K. Kuhn, McCrosky Tool Co., has been made vice chairman; B. L. Diamond, Modern Tool Co., secretary; and Lawrence H. Howe, Lincoln Park Tool & Gage Co., treasurer.

♦

Charles Dorrance has been elected president, West Virginia Coal & Coke Corp., Cincinnati, succeeding Col. Robert W. Lea, who resigned to become vice president in charge of finance, Johns-Manville Corp., New York. Mr. Dorrance has resigned his position as vice president in charge of operations, Consolidation Coal Co. Inc., New York.

♦

J. S. Richards, manager, metallurgical department, American Steel & Wire Co., Cleveland, has announced appointment of the following five new members to the main office metallurgical staff: L. F. McGlincy, formerly open-hearth and hot mill superintendent at Worcester, Mass., now is division metallurgist on heating and hot rolling; R. H. Barnes, heretofore district metallurgist in Cleveland, is division metallurgist on flat rolled products and strip; A. F. Ilacqua, formerly standard practice metallurgist at Worcester, is assistant division metallurgist on high-carbon products; John F. Occasione is assistant division metallurgist on coatings, whereas formerly he was in charge of similar work for the Cleveland district; J. E. Millen, previously in charge of statistical work in the physical laboratory, Cleveland district, is assistant division metallurgist on standard practice.

DIED:

■ HUGH M. RICHARDS, 51, manager of strip and sheet sales, American Rolling Mill Co., Middletown, O., in Middletown April 6. Mr. Richards was associated with the company's sales department many years. From 1924 to 1931 he was sales manager in the Cleveland area; later was named assistant general manager of sales; in July, 1937, was appointed manager of strip and sheet sales.

♦

George F. Libby, 37, director of sales and advertising manager, Master Lock Co., Milwaukee, April 2 in that city. He joined the firm 15 years ago.

♦

William P. Carpenter, treasurer, Mullins Mfg. Corp., Salem, O., until his retirement in 1932, recently in that city. He had been with the firm 52 years, 41 of which he was treasurer.

♦

Walter H. Neubert, 62, the past 18 years chief tool supervisor, A. O. Smith Corp., Milwaukee, in that city, recently. He was one of the four original employes of the company when it started manufacturing bicycles many years ago.

♦

Bruce Hill, first vice president and sales manager, Hill & Griffith Co., Cincinnati, and well known in the foundry industry, in Cincinnati, April 5. Mr. Hill was active in the Cincinnati chapter, American Foundrymen's association and was chairman of the finance committee which was making arrangements for the forthcoming convention of the A.F.A. which will be held in that city in May.

♦

Thomas S. Grubbs, 66, vice president, Union Switch & Signal Co., Swissvale, Pa., April 2 in that city. He joined Westinghouse Machine Co. in 1888 and when the company was merged with Westinghouse Electric & Mfg. Co. in 1915 he became secretary and auditor. In that year he was elected secretary, Union Switch & Signal Co., subsequently becoming treasurer and vice president. Continuing in those positions he also was elected comptroller, Westinghouse Air Brake and subsidiaries in 1927.

"It's my job to save space ..keep down weight"

THE DESIGNER

"I've got to make it work!"

THE ENGINEER

"It's up to me to find the best source of supply"

THE P. A.

"I've got to use it... will it satisfy?"

THE CUSTOMER

When all four agree the result is not always the cheapest part . . . nor the most expensive part . . . BUT THAT PART WHICH DOES BEST the things required of it.

BARNES-MADE SPRINGS are made with a sympathetic ear to the customer's problem . . . and an eye to his assembling costs.

You'll find BARNES-MADE PRODUCTS in chain-store merchandise . . . in Production Lines of automobile makers . . . refrigerator manufacturers . . . even in priceless laboratory equipment.

Knowing how GOOD to make it is just as important as knowing HOW to make it.

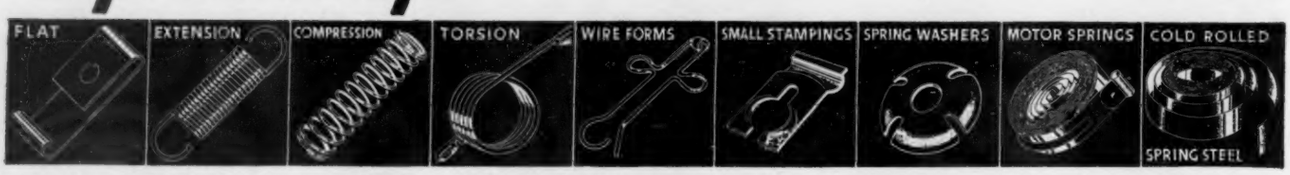
Next time and forever after "GET A BARNES QUOTATION"

Springs

The Wallace Barnes Company

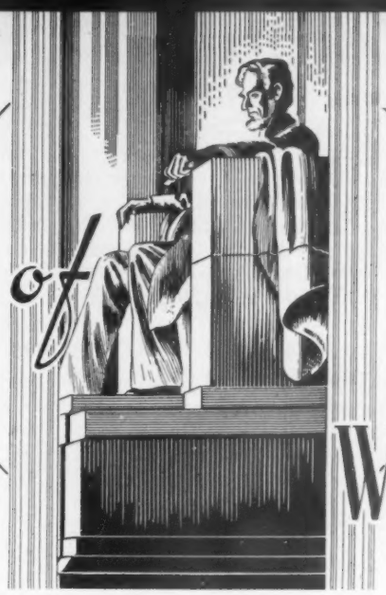
DIVISION OF ASSOCIATED SPRING CORPORATION

BRISTOL, CONNECTICUT



SPRINGMAKERS FOR MORE THAN THREE QUARTERS OF A CENTURY

Windows of WASHINGTON



By L. M. LAMM
Washington Editor, STEEL

WASHINGTON

■ ARGUMENT on the appeal of seven eastern steel mills from a lower court decision refusing to make permanent an injunction against minimum steel wage schedules under the Walsh-Healey act was heard in District of Columbia court of appeals last week.

O. Max Gardner and Frederick O. Knight represented the steel companies while Edward J. Ennis of the department of justice and C. E. Rhetts of the labor department represented the government. Associate Justices Justin Miller, Henry W. Edgerton and Fred M. Vinson heard the case.

The appellate court granted the steel industry a temporary injunction against the secretary of labor, delaying enforcement of minimum wages until it has decided the case. At the argument last week the government asked dismissal of the injunction or, failing that, that the steel companies be required to post bond. Then if government finally wins the case the steel companies would be required to pay the difference in back wages. Court did not indicate when it would rule on this motion.

Both sides were given until April 11 in which to file further briefs.

Counsel for the steel companies discussed location of the various plants, minimum wages paid and collective bargaining agreements.

Attacks "Locality" Interpretation

Mr. Knight argued the principal grounds on which the determination was attacked. That dealt with the word "locality" as used in the act itself and as referred to in the labor secretary's decision.

He charged the construction by the labor department of the term was "plainly erroneous as matter of law and that the determination predicated thereon was, therefore, beyond the statutory authority of the secretary of labor."

Mr. Knight said the steel companies claim that "under the guise of construction of the term 'locality' the determination attempts to raise wages, by fixing minimum wages never theretofore existing in the several localities in which appellants' plants are situated, instead of ascertaining what in fact are the prevailing minimum wages, currently paid and actually prevailing in such localities, as required by the act.

"Such wage raising and fixing, it is claimed, was sought to be accomplished by including such localities in a large region also embracing Pittsburgh, Youngstown, and other localities to the west in which, because of various geographical advantages enjoyed by the plants situated therein, the prevailing minimum wages for iron and steelworkers are higher than those in the localities in which appellants' plants are situated and labeling such large region, consisting of 13 states, part of a fourteenth, and the District of Columbia, a 'locality' within the meaning of the act."

Questions Constitutionality

It was further contended by counsel for the steel interests that "locality," as employed in the act, means the city, county, village or other civil subdivision of a state in which work under a particular government contract is to be performed, or the immediate vicinity of that place, or, at most, a narrowly restricted geographical area.

Steel counsel also spoke of the injury which already has occurred to the appellants "due to the unlawful invasion of their rights" and what is actually threatened in the immediate future. It was further contended by counsel that the construction placed on the act by the secretary would, if sustained, raise "grave doubts as to the constitutionality of the statute."

Government counsel contended the steel companies have no standing to sue "because they have no legal right which will be injured or interfered with by the prevailing minimum wage determination of which they complain."

It was argued by government counsel the steel firms "have no legal right to do business with the United States government." It was contended since the companies have no legal right to do business with the government at all, "the asserted illegality of the minimum wage determination is irrelevant."

The government argued the steel companies have no legally protected right to be free from impairment of their competitive position to bid successfully for government contracts.

He argued that even if the companies "may be said to have a standing to sue" that the prevailing minimum wage determination of which they complain is not subject to judicial review.

Concluding government argument: "This court has no jurisdiction to review the prevailing minimum wage determination of the secretary of labor of which these appellants complain. This jurisdictional deficiency is not related to the position of these particular appellants, but goes to the power of the court to review the determination, as such, at all. Whether the determination may be reviewed in a different type of proceeding is another question, but consideration of this character cannot affect the conclusion as to the status of the complaint in the present proceeding."

The court has taken the case under advisement.

SENATE VOTES $600,000 FOR ECONOMIC COMMITTEE

Senate has passed a joint resolution providing an additional appropriation of $600,000 for expenses for the temporary national economic committee.

When this committee was created last year, an appropriation of $500,000 was allowed; that money al-

ready has been expended. The additional $600,000 which has just been appropriated by the senate and which will undoubtedly pass the house soon will provide for the activities of the committee until Jan. 1, when congress will make further appropriation if necessary.

Security and exchange commission has announced through the national economic committee that it has begun a nation-wide fact-finding study for the needs of small business for capital financing.

Object of the study is to obtain a concrete picture of the financing problem faced by small businesses. Facts sought include: (1) detailed estimates of the needs of small business for capital financing; (2) the various sources of capital and the various financial channels through which small businesses may obtain financing; (3) the factors which may operate to prevent small businesses from obtaining capital.

The commission's study, being conducted by the investment banking section of its monopoly study division, will include both a thorough analysis of the reports of private credit agencies and on-the-ground field surveys in selected areas and key cities.

URGES RESEARCH IN SMALL BUSINESSMAN'S PROBLEMS

Secretary of Commerce Hopkins last week sent a letter to Representative Lea, chairman, house interstate and foreign commerce committee, endorsing a bill to provide an appropriation of $2,000,000 for the commerce department for business research.

The bill provides the department furnish assistance to small business through research into their problems similar to the research facilities now available to large business enterprises.

Secretary Hopkins said he believed the program proposed "should be directed particularly to the vital needs of small business enterprises which was not done in the original bill." The bill, as introduced in the house by Representative Lea, simply made provision for business research within the department of commerce but did not specifically mention small business.

REDUCE DUTY ON GALVANIZED SHEETS IMPORTED BY TURKEY

In the trade agreement between the United States and Turkey, a 5 per cent reduction is provided on zinc-galvanized iron and steel sheets, up to a minimum of 3 millimeters, imported into Turkey.

Large quantities of American sheets have been imported in competition with the local industry under the pre-agreement rate of duty, the ad valorem equivalent of which was approximately 36 per cent. This item is one of the largest, in point of value, in Turkey's imports from the United States. In 1937, imports of galvanized sheets from the United States were valued at about $1,000,000 Turkish pounds ($880,000) and represented 91 per cent of the total Turkish imports of this item.

PATTERSON SILENT ON "BUSINESS APPEASEMENT"

While predicting good business for 1939, Richard C. Patterson Jr., assistant secretary of commerce, did not discuss business "appeasement" when he talked here last week to representatives of the electrical manufacturing industry. In fact, no administration spokesman has had much to say during the past couple of weeks about co-operation with the government—leading topic some weeks ago.

Mr. Patterson told the manufacturers there were many elements of strength in the present situation and called attention to the increased national income, improved profits, the absence of inventory liquidation and "burdensome stocks in distribution channels and increased employment."

An important factor in assuring further business expansion, he said, "is the maintenance of price policies on the part of business which will foster a further expansion in output, and not choke off, by short-sighted action, the demands which can only be met by a program which has high volume as its objective."

PROPOSE AMENDMENTS TO LABOR RELATIONS ACT

B. C. Heacock, president, Caterpillar Tractor Co., Peoria, Ill., and a special committee of business men representing the United States chamber of commerce in a report just made public urged substantial revision of the national labor relations act to eliminate unfair and discriminatory provisions.

"There has been ample demonstration that the law has had the effect of disrupting rather than of promoting amicable relations between workmen and those for whom they work," the report states. "It has promoted public disorder and disregard for personal property rights, in defiance of constitutional and statutory safeguards. It has injected the federal government as an active and as a biased participant into the field of labor disputes, not only as between employers and employes but also as between rival labor organizations.

The committee made a number of recommendations for amendments which it believes will correct some of the inequalities in the act. These amendments would include giving employers the right to petition for certification of bargaining agencies; to guarantee the right of freedom of speech between employers and employes; to prohibit coercion from any source; and to limit labor organization representation to its own members in collective bargaining negotiations.

Still other amendments proposed would repeal the closed shop proviso; restrict the labor relations board to the determination of facts, transferring its judicial functions to the federal courts or some other appropriate agency.

GOVERNMENT IRON, STEEL AWARDS AGGREGATE $147,836

During the week ended April 1, the government purchased $147,835.73 worth of iron, steel and their products under the Walsh-Healey act as follows: Keystone Steel & Wire Co., Peoria, Ill., $12,966.84; Crucible Steel Co. of America, New York, $26,427.50; Albert & Davidson Pipe Corp., Brooklyn, N. Y., $54,496.42; The Timken Roller Bearing Co., Steel & Tube Division, Canton, O., $18,440; The Aluminum Cooking Utensil Co., New Kensington, Pa., $12,170.97; Commercial Iron Works, Portland, Oreg., $10,549; and Fassler Iron Works Inc., New York, $12,785.

Tennessee Increasing Pre-Fabricated Capacity

■ Installation of machinery required for quantity production of cold formed steel sections to be used in prefabricated building units for houses and other structures has been started in the Tennessee Coal, Iron & Railroad Co.'s fabricating shop at Fairfield, Ala.

Equipment to be installed includes forming, welding, assembling, painting and drying machinery. The work will require approximately five months. In addition to new equipment purchased, much of the machinery now in use at the fabricating shop will be modernized.

Tennessee entered the prefabricated metal structures field several months ago, producing standard panel sections with facilities then available in the fabricating shop. Fourteen units of farm dwellings and outbuildings were sold to the Farm Security administration for erection on rural sites in Alabama, Georgia, South Carolina, Florida.

Recently an accumulation of foreign and domestic orders made it necessary to quicken production.

"This company does not expect to go into the erection or retail sale of the structures," said Robert Gregg, president. "It is our intention to supply the prefabricated material to contractors, builders, or large-volume purchasers."

AVIATION

DELIVERIES ACCELERATED ON $200,000,000 AIRCRAFT BACKLOG

■ MILITARY aircraft builders are speeding up deliveries on current unfilled orders to clear production facilities for the large "rush" contracts impending under army and navy air expansion programs. Bookings totaling $95,000,000 since Jan. 1 have raised backlogs to more than $200,000,000, a record high. A year ago backlogs amounted to $140,000,000.

Observers predict the aircraft industry's total 1939 output will approximate $225,000,000, compared with an estimated $170,000,000 last year.

Foreign buyers placed 85 per cent of this year's new business. It is pointed out warplanes and parts have comprised 90 per cent of the $190,000,000 in armament licensed for export since the neutrality act became effective in 1935. Best customers: Great Britain, China, Netherlands East Indies and France.

Credit negotiations for purchasing airplane engines costing $15,000,000 have been completed by the Chinese nationalist government with American engine manufacturers, including United Aircraft Corp.

Royal Dutch Airlines has just placed an order with the El Segundo division of Douglas Aircraft Co. Inc., El Segundo, Calif., for four 16-passenger DC-5 transport planes.

Navy contracts awarded last week: Brewster Aeronautical Corp., Long Island City, N. Y., planes and parts, $321,529; and Wright Aeronautical Corp., Paterson, N. J., engines, $248,057.

Brewster also booked an order from W. L. Maxson Corp. for two experimental radio-controlled planes designed for gunnery practice.

Harvill Aircraft Die Casting Corp. last week was organized in Los Angeles with capital of $500,000. Marcus L. Roberts, Los Angeles, is representative. Also newly-formed is Mercury Aircraft Inc., Los Angeles, capitalized at $75,000.

Seek To Finance Expansion

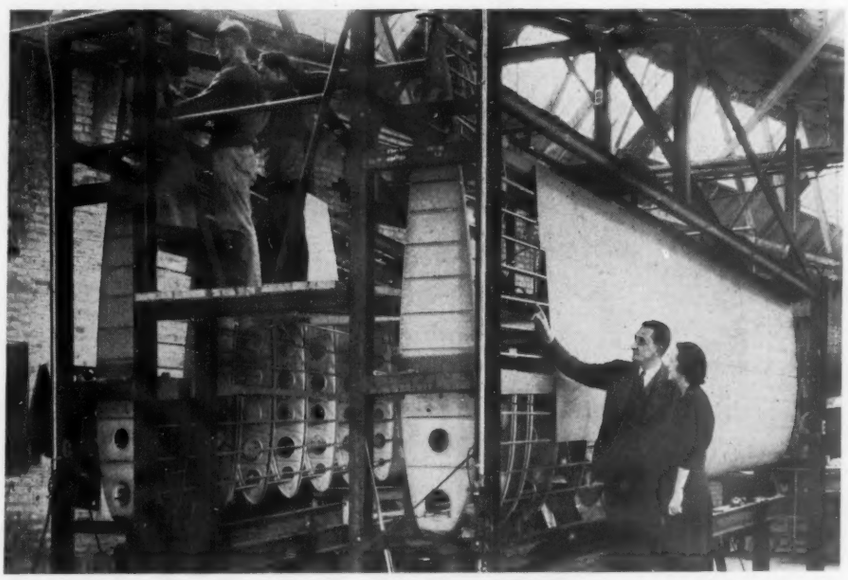
Aeronautical concerns recently announcing new security issues for expanding plant facilities and increasing working capital: Steel Products Engineering Co., Springfield, O., $840,000; United Aircraft Products Inc., Dayton, O., $567,000; Menasco Mfg. Co., Los Angeles, $400,000; Fairchild Engine & Airplane Corp., Hagerstown, Md., $86,200; and Seversky Aircraft Corp., Farmingdale, L. I.

Improvement in flying safety currently is reflected in substantial traffic gains by passenger carriers. National Safety council last week reported the past winter was best from standpoint of safety in the 12-year history of commercial air transportation. Only two major accidents occurred.

Plans for "urban airports" enabling airlines to bring their passengers into the center of metropolitan business districts are advanced by George and Andrew Farkas, British engineers now in the United States. Proposed flat-roofed, multi-storied structures in downtown areas would provide landing and storage space for rotary-wing aircraft of the autogyro and helicopter types which would operate shuttle service to the outlying air terminals.

New light-weight, 500-horsepower airplane engine which is said to be 200 pounds lighter than similar models has been developed by Ranger Engineering Corp., Farmingdale, L. I. Of the air-cooled, in-line type, it weighs 640 pounds, or 1.28 pounds per horsepower.

Fabricate Wing Panels in Steel Frame



■ Wing panels of the new Vega airplane being fabricated in steel jigs at the Burbank, Calif., plant of Lockheed Aircraft's Vega division. The craft introduces to aviation a new type of power plant, the "Unitwin," comprising two Menasco engines mounted side by side and driving a single propeller. If one engine stops, a free-wheeling device prevents it from dragging on the other, which continues in operation

Finds Great Deficiency In Capital Facilities

■ Reduced financial resources available to business since 1930 have created the greatest deficiency in capital facilities in our history, according to *Capital Goods and the American Enterprise System*, published last week by the Machinery and Allied Products institute, Chicago.

"The way to recovery and prosperity in America lies in supplying this deficiency," the book continues.

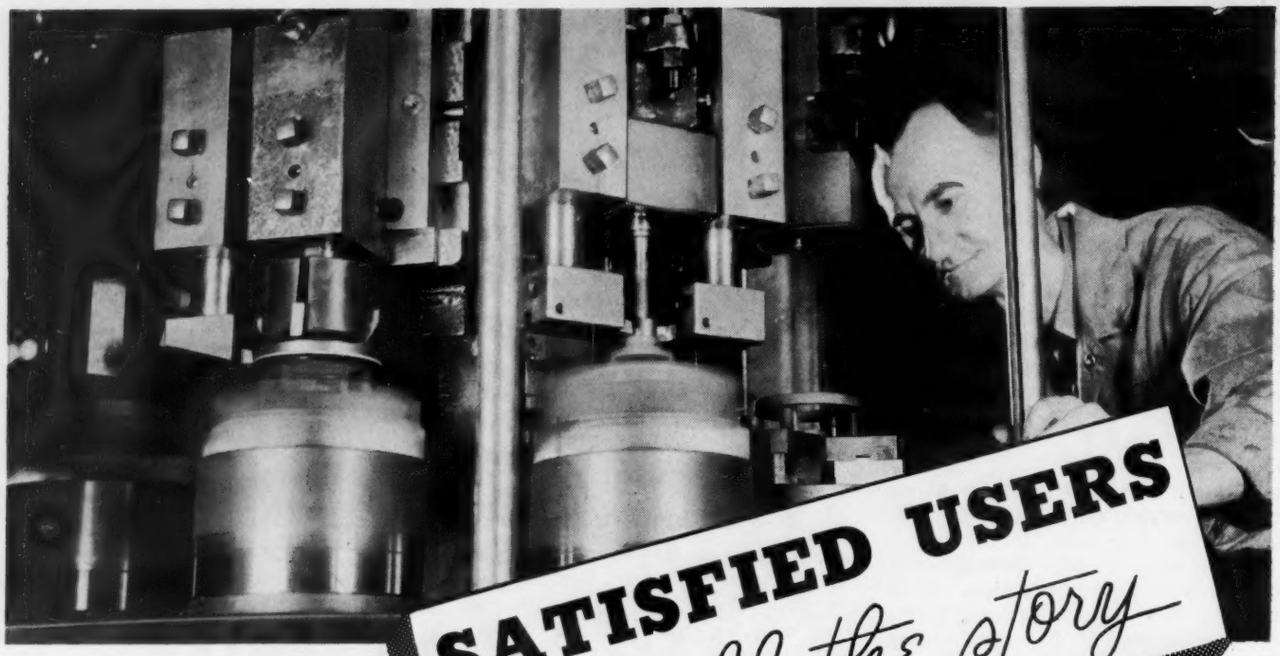
By the end of 1938 there was a deficiency of more than $61,500,000,000 in business savings; new security issues in recent years have averaged only 17.5 per cent of the annual volume in the 1920's, and use of bank credit has declined drastically.

"There is overwhelming evidence that there has been serious stoppage of the flow of savings and credit into business enterprise. This is the outstanding phenomenon of this decade of depression."

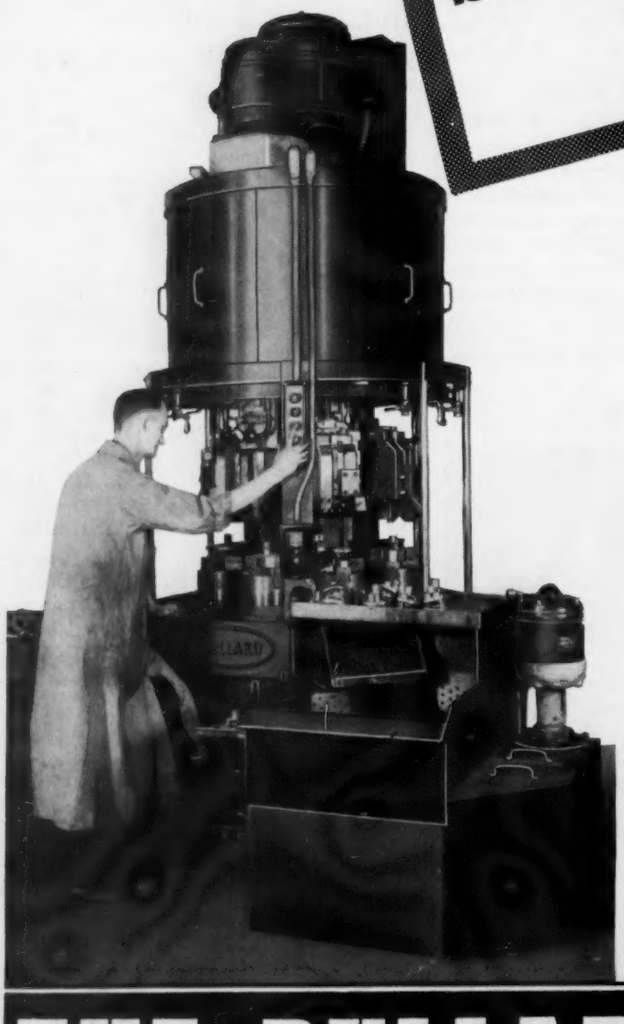
Books Two Open Hearths For Dominion Steel

■ Arthur G. McKee & Co., Cleveland, have booked an order for two 100-ton open-hearth furnaces for Dominion Steel & Coal Corp. Ltd., Sydney, Nova Scotia. Construction will begin in about 30 days.

The corporation now has 12 open-hearth furnaces, including two 100-ton and ten 50-ton units, with total annual capacity of 400,000 gross tons. The new open hearths will increase this to 540,000 tons. It also has one electric furnace with annual capacity of 25,000 tons.



SATISFIED USERS *tell the story*



J-7 MULT-AU-MATIC

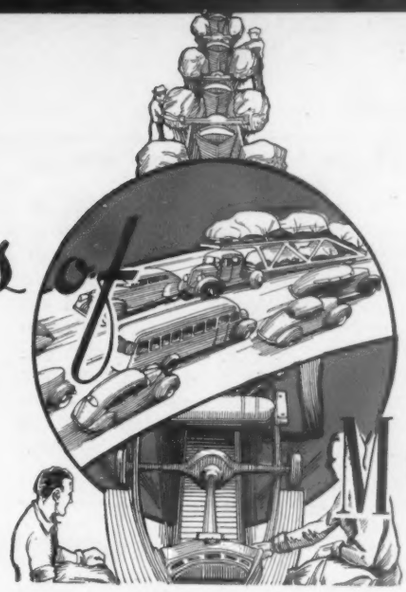
Here's a case where the Type "J-7" Mult-Au-Matic was tooled for several comparatively short run jobs. It proved so Profitable on the original set-up that it was considered unprofitable not to find other jobs to be done the Mult-Au-Matic way. Today there are eleven different jobs being done on this machine and more to come.

Said one man: "If we can make money this way, I can't see why others don't jump at the chance, too."

We'll help. Send in your Problem jobs, because as a rule Problem jobs are no Problem at all when set-up on the Mult-Au-Matic.

THE BULLARD COMPANY
BRIDGEPORT, CONNECTICUT

Mirrors of MOTORDOM



By A. H. ALLEN
Detroit Editor, STEEL

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DETROIT

■ WITHIN the next two weeks assemblies should be started on the Crosley midget car, first mentioned in these columns May 9, 1938.

In the past year this project has blown hot and blown cold a number of times, as late as last September being to all appearances dead. Shortly after the first of this year, however, it was reopened, although for about six weeks even those close to the Crosley organization denied any rebirth of activity. Looking back on this four-month suspension of activity, some observers read into it a reshuffling of personnel by Mr. Crosley himself.

Early assemblies at the Richmond, Ind., plant of Crosley likely will be confined to a few hundred jobs, with production getting into full swing around May 1. It will be recalled the car is to be a single-seat type accommodating three passengers, built on rather short wheelbase and a narrower than conventional tread. Power unit is a 2-cylinder engine being built by Waukesha Engine Co. Bodies and frames are being supplied by Murray here. Spicer Mfg. Corp. in Toledo, O., is building axles, and within the last three weeks contract for wheels is reported to have been placed with Motor Wheel Corp. at Lansing.

Naturally a number of other suppliers figure in the business, and there are some parts, seat cushions for example, still to be placed. But, by and large, arrangements have been concluded for the bulk of the production needs.

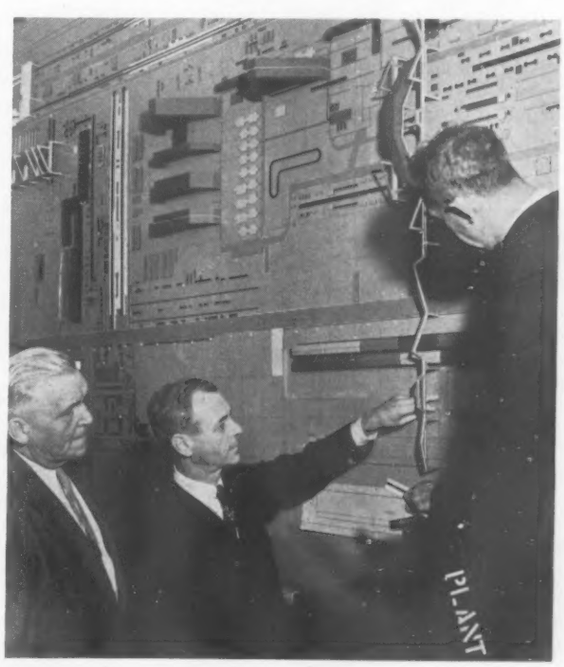
Novelty, price and economy naturally will be the three major talking points in connection with sale of the Crosley venture into the automotive field, which marks the culmination of a 20-year hobby on the part of Mr. Crosley and complements his interests in the radio receiving and broadcasting, refrigerator, baseball, hairgrowing machine and other lines. Originally, it is related, a price of $299.50 was determined for the new car, but later cost analyses may show it necessary to increase this somewhat to between $300 and $400 which would still put the product below any other car in price.

With a small 2-cylinder engine, economy of 50 miles per gallon does not appear improbable. And there is no disputing the novelty incident to introduction of such a vehicle to the American automobile trade. These three factors may combine to make a success of the venture in a market which other car manufacturers do not cultivate except insofar as used cars are concerned.

One authority reasons that if Crosley does not go beyond, say 75,000 assemblies per year, he may be able to avoid serious competition with other manufacturers and at the same time realize a fair profit for his company, by the same token providing employment to several thousand and developing a new market for materials and equipment necessary to manufacture of the car.

On the other hand, experienced persons in the automotive and allied industries in this territory are practically unanimous in refusing to concede the possibility of success to the Crosley venture. They reason the automobile buying public in this country will purchase an inexpensive used car in preference to a new car below standard in size and power. Whether this viewpoint is correct or not will be proved in the

Layout Board Aids Planning



■ When the question of relocating present plant equipment or installing additional machines comes up, this three-dimensional master layout board of the Plymouth plant in Detroit is of valuable assistance. Here D. S. Eddins, Plymouth president (center), and P. C. Sauerbrey, production vice president (left), consult with plant engineer C. C. Williams on some proposed changes in connection with 1940 models

next year or two. Certainly the appearance of a new name on the automobile horizon is a welcome sign, one which should be hailed for its healthy effect on the rest of the industry.

■ SUPPLEMENTING recent comment in this department with regard to Hupmobile, S. L. Davis, president, in an interview with the writer, states there has been "absolutely no friction with any of the corporation's suppliers," that plans for introduction of the Skylark models are proceeding on schedule, that the first bodies for a lot of 30 cars were received last week from Hayes at Grand Rapids, that assembly of an initial run of another 700 cars will follow directly.

Regular line production of Skylarks, on the basis of 2000 per month, will be initiated as soon as tooling is completed. The first 730 jobs are being assembled partly from materials received in inventory at the time of the purchase of property of the Cord Corp. From the windshield forward, the Skylark has been redesigned from the former Cord style, but the balance of the car is practically identical. Mr. Davis reports 6000 orders for Skylarks are now in the hands of dealers and every effort is being made to speed production to fill these orders.

Senior Models Lower

Incidentally, the senior Hupp lines for 1940 will show a more definite resemblance to the Skylark models, and both sixes and eights will be lowered about 3½ inches in overall height, as well as appreciably in price. The 1939 run on senior models is being concluded this month.

Recently, Mr. Davis addressed a group of dealers here and drew a rather interesting picture of the car of tomorrow. Quoting:

"We see an engineering revolution in the motor industry. We see the horse-and-buggy type of construction, which has existed for more than 40 years, suddenly changed by a new and better order of things. This change should be brought about by an independent manufacturer. The new order of cars will be made practically without dies. Die costs now are the greatest and most serious problem facing the independent.

"This revolutionary new car will be attractive, roomy, comfortable, safe, economical, low priced. We see an entirely new type of body construction, starting first with a molded top of a tempered insulating material with the strength of steel and with insulating qualities that have never been approached or seriously considered in the construction of passenger cars which are still too hot in summer and too cold in winter."

Hupp's Fostoria, O., division, by the way, is reported to be preparing to manufacture aircraft parts.

Automobile companies all are keeping a weather eye posted on aircraft developments. General Motors, for example, has readied a $5,000,000 improvement program for its Allison engine division at Indianapolis, reported to be awaiting government approval of the new liquid-cooled engine developed for high-speed pursuit ships. News came out of Washington last week that the war department shortly would authorize the purchase of 550 engines for use in these 400-mile-per-hour army planes.

A further well-authenticated report is that discussions have been initiated leading to a joint effort on the part of General Motors, Du Pont and the Budd interests in the mass production of airplanes of "shotwelded" stainless steel and plastics—Budd supplying the stainless steel welding technique, Du Pont the plastics and GM the mass production technique plus its knowledge of diesel engine building.

The plastics industry continues to make important strides, both in automotive and aircraft fields. One of the latest achievements is an aircraft wing section of molded plastic which meets demands of weathering and strength. Firestone Steel Products Co. in its plant here is now making steel instrument panels of cold-rolled strip and then molding over them a layer of plastic material.

Last week, at Franklin institute in Philadelphia a demonstration was witnessed by officials of five companies sponsoring the development of a new type of combination glass and plastic—the latter a polyvinyl acetal resin—which would appear to have important possibilities for automobiles. Six years of research, involving an outlay of $6,000,000, were required for perfection of the material which is said to be about five times more bendable than ordinary safety glass. It may even be rolled up like a rug without the glass particles leaving the plastic. DuPont, Libbey-Owens-Ford, Pittsburgh Plate Glass, Monsanto Chemical and the Carbide & Carbon Chemicals Corp. participated in the joint research.

■ BABY depression which has developed with the past four weeks shows no very definite signs of let-up and the next few weeks should tell the story as to whether it will be prolonged throughout the summer or give way to the normal spring improvement. A disposition is noted on the part of auto companies to spread releases for parts required on the balance of 1939 runs over considerably longer periods, indicating perhaps a tapering in assemblies this month and next. For example, one consignment of parts originally required to supply four weeks' production in April was revised, without changing quantities, to cover five weeks, then six weeks, and finally held up entirely.

Meanwhile, 1940 programs are slow to mature, tool and die interests stating that a large volume of work is anticipated but, with few exceptions, has yet to be released. Other than a small amount of De Soto work, little has appeared from Chrysler, while Buick and Ternstedt are about the only GM divisions which have released appreciably. As time wears on, it appears the reported decision to speed up new models so they could be exhibited at the coast fairs in July or August was somewhat premature, and from present indications it will be late summer before a general representation of 1940 creations can be displayed. This would indicate a rather protracted changeover period this summer, since already a disposition is noted to bring production of current models to an early close.

Addition to the Willys-Overland line of a new series of cars to be known as the Speedway special has been announced. The models include deluxe equipment and sell at standard car price.

Automobile Production

Passenger Cars and Trucks—United States and Canada

By Department of Commerce

	1937	1938	1939
Jan.	399,186	227,130	353,946
Feb.	383,900	202,589	312,141
March	519,022	238,598	.....
April	553,231	238,133	.....
May	540,377	210,183	.....
June	521,153	189,399	.....
July	456,909	150,444	.....
Aug.	405,072	96,936	.....
Sept.	175,630	89,623	.....
Oct.	337,979	215,296	.....
Nov.	376,629	390,350	.....
Dec.	347,349	407,016	.....
Year	5,016,437	2,655,777	.....

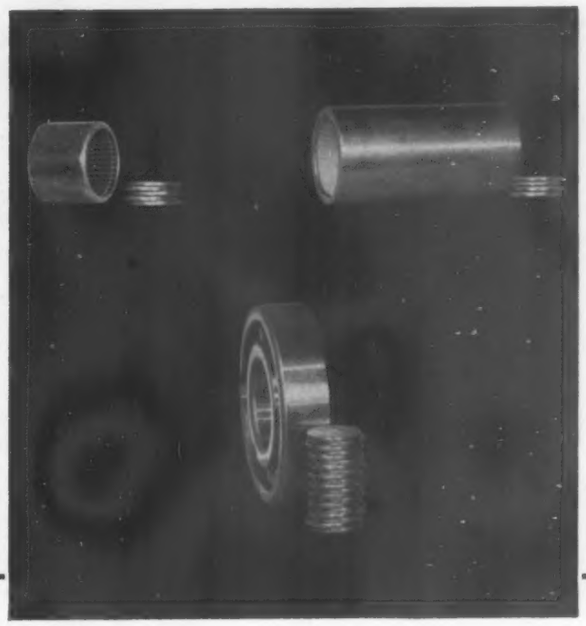
Estimated by *Ward's Reports*

Week ended:	1939	1938†
March 11	84,095	57,438
March 18	86,725	57,555
March 25	89,400	56,800
April 1	85,980	57,500
April 8	87,019	60,975

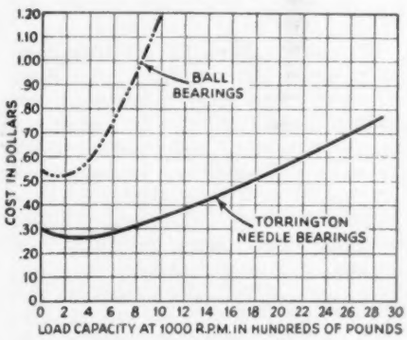
†Comparable week.

	Week Ended April 8	Week Ended April 1
General Motors	32,735	33,260
Chrysler	20,525	20,375
Ford	22,230	22,230
All others	11,529	10,115

SEE HOW LITTLE the TORRINGTON Needle Bearing Costs You



Note in the accompanying graph the low cost of the Torrington Needle Bearing, compared with ball bearings designed to carry the same radial load. See how little it will probably cost you to use this new bearing—and to get the advantages of anti-friction construction in your products.



And its low purchase price is only one of the economies you can effect by using the Torrington Needle Bearing. The bearing is made in a single compact unit, so that you can install it with a minimum of assembly time and expense. It can be quickly pressed into place on an ordinary arbor press—a method ideally adapted to the requirements of production line assembly.

You can often make other savings in the design of surrounding members. The shape of the bearing—its small diameter and long axis—allows you to use an extremely simple form of housing, with a consequent reduction in the amount of material needed.

High Load Capacity

The Needle Bearing has unusually high radial load capacity in proportion to its size, because its full complement of small diameter rollers provides many linear inches of bearing contact. It is suitable for severe service in either rotating or oscillating applications, and gives excellent results when used in high speed operation.

Lubrication of the Needle Bearing is efficient and thorough. The hardened retaining shell that forms the outer bearing race is provided with turned-in lips that hold plenty of grease or oil for long periods of operation. As the needles rotate, they constantly supply lubricant to the rotating shaft, insuring satisfactory lubrication with a minimum of maintenance attention.

Investigate the advantages of this low-cost anti-friction bearing in your own products. The Torrington Engineering Department will cooperate with you in laying out suitable applications for the Needle Bearing.

For further information, write for Catalog No. 10. For Needle Bearings to be used in heavier service, request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings

Branch Offices in all Principal Cities

TORRINGTON NEEDLE BEARING

U. S. Steel "Reasonably Hopeful"; Finds Taxes Increasing Burden

■ "WE ARE reasonably hopeful concerning the immediate outlook for the steel industry," Edward R. Stettinius, board chairman, told United States Steel Corp. stockholders at their annual meeting in Hoboken, N. J., April 3.

Mr. Stettinius pointed out, however, that to forecast the future course of business "in these times is venturesome, to say the least."

Production for the first quarter this year averaged around 52 per cent, substantially better than the 1938 average. The board chairman noted a revival in demand for the heavier steel products, which, he said, should draw more evenly on finishing capacities and materially benefit operations of subsidiary companies.

Taxes, said Mr. Stettinius, loom more formidable than ever as a cost factor, particularly in a year of reduced tonnage volume. From this heavy charge he could foresee no relief.

Taxes $5.61 Per Share

Last year the corporation's total tax bill amounted to $48,842,131, equal to $5.61 per common share.

Taxes in 1938, he continued, other than federal income tax based on earnings, were $45,912,131, an increase of 22 per cent over 1929 and 30 per cent over 1926. Of total 1938 taxes, $11,309,215, or $1.30 per share of common stock, represented taxes paid in connection with social security legislation.

"This becomes increasingly significant when we realize that social security taxes are on a progressive scale, and do not reach their maximum until 1949.

"Thus, assuming that our payrolls in that year were in the same aggregate amount as in 1938, and the social security taxes we were required to pay in 1949 were at the rate now contemplated by the social security act, our taxes in that year for social security alone would amount to $16,000,000, and for a year of normally good operations, to as much as $26,000,000."

Important shrinkage in volume last year, combined with lower prices during part of the year, explained the corporation's reduction in sales, profits and employment, Mr. Stettinius said.

Attendance exceeded 250, second only to last year's record turn-out, when changes in the corporation's capital structure were voted. Proxies represented 2,198,089 shares of preferred stock, or 61 per cent, and 4,877,889 common shares, or 56 per cent. Total representation was 7,075,987 shares, or 57.5 per cent.

Robert C. Stanley, chairman and president, International Nickel Co., New York, was elected a director, to succeed Walter S. Gifford, president, American Telephone & Telegraph Co.

At the directors' meeting the following day Mr. Stanley was elected a member of the finance committee, succeeding Mr. Gifford. William A. Irvin, in accordance with his request last year, and after 44 years of distinguished service, retired as vice chairman of the board, which position was abolished. He will continue as director and member of the finance committee. All other officers were re-elected.

A feature this year was the presentation of a sound motion picture of the planning, construction and operation of the corporation's new Irvin works. This showing was held while the ballots were being counted.

Time of the meeting this year was advanced to 10:30 o'clock, instead of about noon as heretofore. This, it was believed, would be more convenient for stockholders. The usual lunch was served after the meeting had adjourned.

A new type of ballot was used, on which were printed the names of 35 independent auditing firms, with the name of another written in by a holder of ten shares of stock. Price, Waterhouse & Co., New York, received the votes of 7,109,802 shares, with the runner-up receiving votes of about 1700 shares.

Will Continue Pension System

In reply to a stockholder the chairman stated the corporation planned to continue its pension system, in conjunction with the social security act, but added it was impossible to say yet just how the two systems ultimately would be combined. The corporation is giving close study to the problem, he added. In reply to another stockholder, he said Myron C. Taylor is not receiving pension from the corporation.

Describing stockholders as "forgotten men and women," J. Newcomb Blackman, a stockholder and vice president of the American Federation of Investors, suggested "collective bargaining for stockholders, as well as steelworkers." He warned that unless stockholders' interests were better taken care of there would eventually be no capital for investment and no jobs for anyone.

He suggested the sentiment of stockholders should be recorded at annual meetings on various types of legislation affecting business and management.

Following recent changes in the corporation's capital structure, the board of directors, Mr. Stettinius said, authorized the application of $260,368,000 out of the capital surplus to reduce the item of intangible assets to the present nominal sum of $1, leaving a balance of $38,462,801 in the capital surplus account.

"It is, of course, not possible," he stated, "to evaluate convincingly what real value the intangible assets possess, but whatever the value may be it is still in existence and is not affected in any manner by the book reduction mentioned."

The net working assets increased last year from $366,000,000 to $433,000,000. The cash and marketable security assets increased from $86,000,000 to $138,000,000.

Predicts Continuance in Machine Tool Gains

■ "Machine tool builders look for a slow strengthening of the mild general upturn that began last summer," said August H. Tuechter, president, Cincinnati Bickford Tool Co., speaking last week before the Cincinnati Credit association.

Sharp advances in machine tool sales since last summer have been due in part to foreign business, but of late there has been an encouraging improvement in domestic orders, he said. These have increased as foreign orders have declined.

Mr. Tuechter estimated 25 per cent of all workers gainfully employed in industry today owe their jobs to industries, dependent on machine tools, which did not exist in 1900 or which were just getting into production at that time. The machine tool industry, he said, employs 50,000 workers. As a result of their production—only a part of which is devoted to automotives—500,000 workers are directly employed in automotive plants and 6,000,000 derive their livelihood from direct and affiliated automotive industries.

■ Sixty-nine employes whose service with the Tennessee Coal, Iron & Railroad Co. totaled 1935 years received United States Steel Corp. service medals during the first quarter of 1939. Their service average for the period was 28.04 years.

The Railroad Problem

■ RAILROAD travelers of late have been handed copies of a little booklet. It has a pale blue cover, with a picture of a carpenter's square, and the title "For Better Times—A Square Deal in Transportation." Prepared by the Association of American Railroads, Washington, it is intended to enable passengers to while away some of the time on long trips while at the same time becoming informed as to the basic causes of the railroad problem.

"Out of every dollar railroads take in, taxes take more than 9 cents, and the annual cost of providing and maintaining the roadway takes 23½ cents more.

"Out of every dollar taken in by the certified motor carriers who report to the interstate commerce commission, 4½ cents goes for taxes of all sorts, including license fees and gasoline taxes—and nothing more for roadway, which is built and maintained by the public.

Unequal Treatment of Carriers Is Root of Railroad Troubles

"Out of every dollar taken in by inland water carriers reporting to the interstate commerce commission, 2 cents goes for taxes—and nothing more for channels, which are built and maintained by the public.

"And the Federal Barge Lines, government-operated competitor of the railroads, pays nothing for taxes and nothing for its channels."

This unequal treatment, says the booklet, is the root of the railroad problem in this country. It goes on to outline measures that would remedy the situation and enable the railroads to get back on their feet.

Contrary to widely held opinion, the railroads are not overcapitalized, says the booklet. In 1910, when railroads as a whole were reasonably prosperous, their total capitalization amounted to $987 for each $1000 invested in railroad property. In 1937, with railroads in distress, total capitalization was only $715 for each $1000 of investment. That part of the total capitalization representing debt amounted, in 1910, to $606 for each $1000 of investment. In 1937 it amounted to only $439 for each $1000 of investment.

Neither, says the booklet, are railroad difficulties due to an increasing burden of fixed charges; that is, interest on debts and rentals for leased property. In 1937 these charges took 15.4 cents out of each dollar of railroad revenue, less than in any of the years prior to the World war, when the railroads were most prosperous.

Industry Has Stake in Aiding Better Understanding of Rail Needs

If enough educational work is done the railroad problem eventually may be solved. This is an effort which well may be shared by industry in general. It is estimated (see STEEL, March 20, page 34) that deferred maintenance on American railroads has mounted to $283,000,000 and that, in addition, these interests should spend $495,000,000 over the next three years—and these figures may be regarded as representing minimum normal requirements. Full participation of the railroads in our going volume of business is important for a return to prosperity.

There is another reason for pushing the educational work that is necessary for solution of the railroad problem. The extent to which the public and our legislative representatives are made to understand what makes the railroads go will make them understand what makes business in general go. A general realization along these lines will lead to increasing ability on the part of business to contribute to the country's welfare.

Steel Industry's Earnings Insufficient

To Pay Funded Debt Interest in 1938

■ TWENTY-TWO leading steel companies, representing 92.5 per cent of total ingot capacity, in 1938 incurred a $10,936,841 net deficit, after all charges but before dividends, STEEL'S thirteenth annual financial survey shows. For 1937, the same producers had $211,479,861 net profit.

Total income, before deducting bond interest, was $22,061,470, compared with $241,938,183 in 1937. Last year's total income, insufficient to meet funded debt interest, indicates 0.57 per cent return on total capitalization. This was the lowest since 1934. In 1937, the 22 companies earned 6.07 per cent on total capitalization. Highest return in recent years was in 1929 when 9.88 per cent on capitalization was reported. Most severe loss was in 1932 at 2.85 per cent on capitalization.

1938 Tax Bill More Than Four Times Total Earnings on Capitalization

Taxes paid by 21 of the 22 companies totaled $94,514,280 in 1938, against $159,992,152 in 1937 for the identical 21. Last year's taxes amounted to more than four times the companies' aggregate earnings on total capitalization, and were approximately twice the preferred stock requirements.

Total capitalization was $3,848,059,550 in 1938, compared with $3,984,383,189 in 1937, a reduction of $136,323,639. Aggregate surplus for all the companies was reduced $91,159,935, although eight of the companies made additions to surplus accounts. Funded indebtedness increased $164,580,306, from $681,069,821 to $845,650,127.

Number of common shares outstanding increased from 33,477,252 to 34,171,336; their valuation decreased from $1,781,998,030 to $1,569,756,693. Preferred shares valuation increased from $729,310,910 to $731,812,237.

For 18 companies reporting, operations averaged 39.3 per cent of ingot capacity in 1938, compared with 71.5 per cent in 1937. Net sales of 19 companies totaled $1,015,773,603, a 39.2 per cent decrease from the 1937 figure of $1,670,958,840. The leading producer, however, did not report net sales.

Midvale Co. showed the highest total earnings on capitalization with 10.06 per cent. Followed Keystone Steel & Wire Co. with 8.23 per cent, Laclede Steel Co. with 5.30 per cent, Continental Steel Corp. with 5.15 per cent, National Steel Corp. with 4.80 per cent, and Inland Steel Co. with 4.73.

Net loss per ton of ingot capacity averaged 17 cents last year, contrasted with a 1937 net profit of $3.30. Midvale earned $4.64 per ton of capacity; Keystone Steel & Wire, $2.91; Rustless Iron & Steel Corp., $2.27; Inland, $2.10. National Steel actually earned $2.32 per ton of capacity on average capacity for the year, instead of the $1.96 listed in the accompanying table which is based on year-end capacity.

Net loss per ton of ingots produced averaged 59 cents for 18 companies reporting; in 1937, the same companies earned $4.38 per ton of ingots produced.

Losses per common share, after allowing for preferred dividend requirements averaged $1.73, contrasted with average earnings of $4.92 in 1937.

Of the 17 largest producers, only two showed earnings on common stock, National and Inland with $3.03 and $3.11 respectively. Midvale Co. earned $6.22 per common share.

Total Assets Slightly Lower; Current Liabilities Reduced

Total assets for the 22 producers were $4,205,487,617, compared with $4,420,105,857 in 1937. Current assets were $1,232,763,683 compared with $1,207,793,633. Current liabilities were reduced from $293,170,590 to $208,357,665.

Opposite this page is an insert giving detailed comparisons for the 22 companies for 1938 and 1937. Extra copies will be sent to subscribers who request them.

Several changes have been made in the list of companies this year. Allegheny Steel Co. and Ludlum Steel Co. merged in August, 1938, and are listed as Allegheny Ludlum Steel Corp.; for the 1937 comparisons, the figures of Allegheny Steel Co. only are used. Colorado Fuel & Iron Co. and Keystone Steel & Wire Co. have been added to the list. Vanadium Alloys Steel Co. has been dropped.

STEEL hereby acknowledges with sincere thanks the co-operation of the company executives for supplying these detailed data.

Financial Analys

Earnings, Capitalization, Assets and Liabilities of 22 Produce

	No. Shares Common Stock Outstanding		Common Stock		Preferred Stock		Funded Debt		
	1938	1937	1938	1937	1938	1937	1938	1937	
United States Steel Corp.	8,703,252	8,703,252	$652,743,900	$870,325,200	$360,281,100	$360,281,100	$248,849,390**	$125,707,961**	$2
Bethlehem Steel Corp.	3,183,984	3,185,114	302,478,480	302,585,830	112,066,440	112,066,440	170,003,362	174,778,045	
Republic Steel Corp.	5,832,856	5,832,124	132,516,450	132,499,470	40,190,050	40,190,050	89,081,830	92,859,148	
Jones & Laughlin Steel Corp.†	576,320	576,320	57,632,000	57,632,000	58,713,900	58,713,900	43,281,353	32,063,470	
National Steel Corp.	2,198,767	2,167,877	54,969,175	54,196,925	None	None	62,747,592	59,054,781	
Youngstown Sheet & Tube Co.	1,675,008	1,675,008	105,056,800	105,039,670	15,000,000	15,000,000	87,000,000	58,500,000	
American Rolling Mill Co.	2,869,560	2,869,560	71,739,009	71,739,009	45,000,000	45,000,000	2,000,000	3,234,816	
Inland Steel Co.	1,577,005	1,573,950	57,464,602	57,311,851	None	None	51,800,000	52,900,000	
Wheeling Steel Corp.	563,294	563,212	28,164,725	28,160,600	37,997,600	38,126,800	32,200,000	32,900,000	
Colorado Fuel & Iron Co.	563,620	563,620	5,636,200	5,636,200	None	None	15,518,200	15,518,200	
Crucible Steel Co. of America	445,198	445,698	44,519,773	44,569,773	23,880,000	23,880,000	11,500,000	6,250,000	
Otis Steel Co.	915,829	896,597	4,579,145	4,482,985	10,313,640	10,675,163	14,106,000	14,251,000	
Pittsburgh Steel Co.	499,442	354,900	4,767,440	3,549,000	15,475,000	12,418,600	5,225,000	5,741,000	
Lukens Steel Co.‡	317,976	317,976	3,179,760	3,179,760	None	None	3,534,400	3,559,400	
Allegheny Ludlum Steel Corp.§	1,256,722	753,985	7,854,512	4,712,637	3,342,600	3,342,600	None	None	
Sharon Steel Corp.	391,611	387,774	3,967,330	3,897,740	5,972,000	5,972,000	None	None	
Granite City Steel Co.	382,488	382,488	8,483,821	8,483,821	None	None	None	None	
Continental Steel Corp.	200,561	200,576	5,276,238	5,276,513	2,390,859	2,455,209	1,453,000	1,202,000	
Midvale Co.	200,000	200,000	10,574,621	10,574,621	None	None	None	None	
Keystone Steel & Wire Co.*†	757,632	757,632	3,156,800	3,156,800	None	None	1,600,000	1,800,000	
Laclede Steel Co.	206,250	206,250	4,125,000	4,125,000	None	None	750,000	750,000	
Rustless Iron & Steel Corp.	871,961	863,339	870,912	862,625	1,189,048	1,189,048	None	None	
Totals	34,171,336	33,477,252	$1,569,756,693	$1,781,998,030	$731,812,237	$729,310,910	$845,650,127	$681,069,821	$7

	Preferred Stock Dividend Requirements		Income Per Common Share		Rated Ingot Capacity Gross Tons		Net Income Per Ton Ingot Capacity		Capitalization Per Ton Ingot Capacity	
	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937
United States Steel Corp.	$25,219,677	$25,219,677	$3.78*	$8.01	25,790,000	25,790,000	$0.30*	$3.68	$60.01	$66.61
Bethlehem Steel Corp.	7,471,096	7,471,096	0.70*	7.64	10,042,000	9,360,000	0.52	3.40	64.67	70.16
Republic Steel Corp.	2,411,403	2,411,403	1.78*	1.14	6,500,000	6,354,342	1.23*	1.42	49.31	51.53
Jones & Laughlin Steel Corp.†	4,109,973	4,109,973	17.33*	1.18	3,660,000	3,660,000	1.61*	1.31	57.35	54.27
National Steel Corp.	None	None	3.03	8.21	3,400,000	2,700,000	1.96	6.59	55.62	66.55
Youngstown Sheet & Tube Co.	825,000	825,000	0.89*	6.79	3,120,000	3,120,000	0.21*	3.91	73.04	63.95
American Rolling Mill Co.	2,025,023	916,954	1.16*	2.55	2,669,520	2,551,120	0.51*	3.25	48.30	51.98
Inland Steel Co.	None	None	3.11	8.05	2,340,000	2,340,000	2.10	5.41	61.27	61.27
Wheeling Steel Co.	1,929,449	1,937,366	2.55*	4.08	1,750,000	1,750,000	0.28	2.42	62.44	63.07
Colorado Fuel & Iron Co.	None	None	2.99*	1.26	885,040	885,040	1.90*	0.80	38.02	39.29
Crucible Steel Co. of America	1,671,600	1,671,600	9.13*	5.21	875,000	875,000	2.56*	4.59	121.16	118.39
Otis Steel Co.	756,332	781,715	2.17*	1.71	828,000	828,000	1.49*	2.80	41.36	42.53
Pittsburgh Steel Co.	869,382	742,638	3.30*	0.24*	809,340	720,000	0.96*	0.91	48.94	51.70
Lukens Steel Co.‡	None	None	0.91*	0.50	638,000	638,000	0.45*	0.25	16.09	16.58
Allegheny Ludlum Steel Corp.§	233,982	233,982	1.04*	2.10	537,000	500,000	1.99*	3.63	48.40	37.84
Sharon Steel Corp.	298,600	249,287	1.01*	2.83	500,000	500,000	0.19*	2.69	31.15	31.38
Granite City Steel Co.	None	None	0.86*	0.66	400,000	400,000	0.82*	0.63	28.76	29.70
Continental Steel Corp.	168,121	173,139	2.32	3.20	325,000	280,000	1.95	2.91	41.05	46.05
Midvale Co.	None	None	6.22	6.71	268,000	268,000	4.64	5.01	46.14	44.92
Keystone Steel & Wire Co.*†	None	None	0.96	1.53	250,000	250,000	2.91	4.64	38.06	38.83
Laclede Steel Co.	None	None	1.61	2.21	235,000	235,000	1.41	1.89	28.37	28.06
Rustless Iron & Steel Corp.	91,292	44,446	0.12*	0.77	35,700	35,700	2.27	19.98	88.77	88.41
Totals	$48,080,930	$46,788,276	$1.73*	$4.92	65,857,600	64,040,202	$0.17*	$3.30	$58.43	$62.22

†1938 figures include Frick-Reid Supply Corp.

‡Fiscal year ends Oct. 15.

§Allegheny Steel Co. merged with Ludlum Steel Co. Aug. 16, 1938. The tabulations under 1937 column represent Allegheny Steel Co. only.

*†Fiscal year ends June 30.

**Includes subsidiary companies' stocks not owned (Principally guaranteed stocks) in the amount of $5,137,051 in 1938 and $5,135,754 in 1937.

*‡Includes $56,999 interest on funded debt retired Oct. 13, 1937.

*Loss.

Totals for 1938 and 1937 for the columns, "Net Earnings before Dividends," do not take into consideration the requirement (not actual payments) for preferred dividends. In computing earnings per common share these totals, adjusted for the preferred dividend requirement, are used. In figuring earnings per common share for individual companies the same method is followed.

Boldface type is used under those columns in which figures from all the 22 companies were not obtainable.

Per Cen

1925
1926
1927
1928
1929
1930
1931

*Loss.

Analysis of the Steel Industry for 19

ies of 22 Producers Having an Aggregate Annual Ingot Capacity of 65,857,600 Gross Tons, or 92

Funded Debt		Surplus		Total Capitalization		Total Income Before Div. and Int. on Bonds		Per Cent Total Income on Capitalization		N
38	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938
49,390**	$125,707,961**	$285,881,814	$361,606,165	$1,547,756,204	$1,717,920,426	$544,874	$100,085,446	0.04%	5.83%	.....
03,362	174,778,045	64,863,198	67,248,455	649,411,480	656,678,770	12,377,847	38,786,013	1.91	5.91	$265,999,937
31,830	92,859,148	58,711,282	67,002,376	320,499,612	332,551,044	3,560,179*	13,963,869	1.11*	4.20	140,879,763
31,353	32,063,470	45,289,755	50,204,472	209,917,008	198,613,842	3,821,747*	6,330,951	1.82*	3.19	75,410,901
17,592	59,054,781	71,389,679	66,433,209	189,106,446	179,684,915	9,076,577	20,231,364	4.80	11.26	89,503,232
00,000	58,500,000	20,818,752	20,993,897	227,875,552	199,533,566	2,025,496	14,785,948	0.89	7.41	84,664,566
00,000	3,234,816	10,192,874	12,623,475	128,931,883	132,597,300	1,200,996*	9,140,629	0.93*	7.52	70,441,606
00,000	52,900,000	34,098,110	33,151,831	143,362,712	143,363,682	6,788,710	14,549,343	4.73	10.14	74,058,924
00,000	32,900,000	10,901,255	11,186,352	109,263,580	110,373,752	2,006,160	5,774,213	1.84	5.23	62,420,280
18,200	15,518,200	12,496,860	13,618,380	33,651,260	34,772,780	907,610*	1,488,125	2.70*	4.28	17,200,574
00,000	6,250,000	26,111,495	28,893,127	106,011,268	103,592,900	1,827,423*	4,361,680	1.72*	4.21	29,125,598
06,000	14,251,000	5,245,272	6,608,346	34,244,057	36,017,494	595,527*	2,961,325	1.74*	8.22	13,718,500
25,000	5,741,000	14,141,873	15,512,541	39,605,312	37,221,141	416,990*	1,054,316	1.05*	2.83	20,827,882
34,400	3,559,400	3,553,370	3,841,876	10,267,530	10,581,035	80,513*	329,333	0.78*	3.11	11,597,016
None	None	14,819,733	10,864,240	26,016,845	18,919,478	1,070,186*	1,813,707	4.13*	9.59	18,261,231
None	None	5,638,080	5,821,604	15,577,410	15,691,344	95,325*	1,402,809*‡	0.61*	8.94	10,505,879
None	None	3,020,160	3,398,198	11,503,981	11,882,019	330,231*	254,225	2.87*	2.14	6,359,472
53,000	1,202,000	4,221,232	3,960,263	13,341,329	12,893,986	687,243	871,509	5.15	6.76	12,801,105
None	None	1,790,797	1,463,172	12,365,418	12,037,793	1,244,210	1,341,816	10.06	11.15	.....
00,000	1,800,000	4,757,390	4,749,597	9,514,190	9,706,397	782,880	1,220,194	8.23	12.57	9,648,839
50,000	750,000	1,792,267	1,718,231	6,667,267	6,593,231	353,090	478,229	5.30	7.25	.....
None	None	1,109,246	1,104,622	3,169,206	3,156,294	81,110	713,139	2.56	22.59	2,348,298
50,127	$681,069,821	$700,844,494	$792,004,429	$3,848,059,550	$3,984,383,189	$22,061,470	$241,938,183	0.57%	6.07%	**$1,015,773,603**

Capitalization Per Ton Ingot Capacity		Ingot Production Gross Tons		Operating Ratio		Net Income Per Ton Ingots Produced		Total Taxes		Total Assets	
1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937
$60.01	$66.61	9,397,371	18,532,278	36.2%	71.2%	$0.82*	$5.12	$48,842,131	$88,048,237	$1,711,279,006	$1,918,729,28
64.67	70.16	4,350,569	7,269,828	43.3	77.7	1.21	4.38	12,120,039	17,847,291	699,474,044	715,809,7
49.31	51.53	2,465,544	4,014,277	37.9	63.2	3.24*	2.25	5,548,309	9,334,681	348,715,525	364,658,7
57.35	54.27	1,358,626	2,472,395	37.1	67.5	4.33*	1.94	4,379,452	6,233,043	227,653,870	219,642,7
55.62	66.55	.....	.....	....	....	.....	....	5,162,695	9,908,969	207,144,871	204,452,6
73.04	63.95	1,186,741	2,009,735	38.0	64.4	0.56*	6.07	3,684,752	6,019,083	241,719,671	220,641,2
48.30	51.98	1,015,030	1,835,371	39.4	72.5	1.29*	4.48	2,453,506	3,441,609	138,849,766	145,844,5
61.27	61.27	1,264,556	1,752,435	54.0	74.9	3.90	7.23	3,249,814	5,541,004	156,506,609	158,326,3
62.44	63.07	919,955	1,327,596	52.6	75.9	0.54	3.19	1,939,301	2,698,118	118,136,783	123,551,2
38.02	39.29	231,387	614,989	26.1	69.5	7.28*	1.16	1,053,593	1,495,842	38,895,234	39,782,4
121.16	118.39	.....	.....	....	....	.....	....	1,421,703	3,019,137	109,276,916	109,824,2
41.36	42.53	.....	.....	....	....	.....	....	682,713	1,251,758	36,813,020	39,025,8
48.94	51.70	378,756	583,430	46.8	81.0	2.05*	1.13	821,326	986,421	44,271,256	41,302,6
16.09	16.58	234,943	447,493	36.8	70.0	1.23*	0.36	314,643	274,159	13,290,736	15,692,1
48.40	37.84	129,345	302,149	24.1	60.4	8.27*	6.15	657,063	1,075,068	29,845,719	20,794,5
31.15	31.38	243,726	412,394	48.7	82.5	0.39*	3.26	367,688	667,639	18,400,293	17,343,2
28.76	29.70	132,796	266,586	33.2	66.6	2.49*	0.95	199,229	269,273	14,346,313	14,839,6
41.05	46.05	208,656	269,985	64.2	96.4	3.03	3.02	490,000	537,774	15,008,754	14,229,6
46.14	44.92	54,568	59,443	20.4	22.2	22.80	22.57	739,990	769,223	14,765,514	14,324,6
38.06	38.83	155,798	238,520	62.3	95.4	4.67	4.87	294,584	378,629	10,202,466	10,678,3
28.37	28.06	139,251	202,736	59.3	86.3	2.38	2.19	.....	.....	7,204,254	7,113,2
88.77	88.41	.....	.....	....	....	....	....	91,749	195,194	3,686,997	3,498,3
$58.43	$62.22	**23,867,618**	**42,611,640**	**39.3%**	**71.5%**	**$0.59***	**$4.38**	**$94,514,280**	**$159,992,152**	$4,205,487,617	$4,420,105,8

Per Cent Earned on Capitalization

1925	5.61	1932	*2.85
1926	6.86	1933	*0.90
1927	5.22	1934	0.36
1928	6.55	1935	2.09
1929	9.88	1936	4.40
1930	4.54	1937	6.07
1931	0.40	1938	0.57

*Loss.

Supplem

r 1938

ons, or 92.5 Per Cent of the Total

Net Sales		Net Profit Margin Per Cent		Net Income Before Dividends		
1938	1937	1938	1937	1938	1937	
%	.....	....	....	$7,717,454*	$94,944,358	.....United States Steel Corp.
$265,999,937	$418,556,528	1.98%	7.62%	5,250,239	31,819,596	.....Bethlehem Steel Corp.
140,879,763	250,447,744	5.68*	3.61	7,997,825*	9,044,148	.....Republic Steel Corp.
75,410,901	117,471,743	7.80*	4.08	5,879,958*	4,788,799	....Jones & Laughlin Steel Corp.†
89,503,232	145,933,348	7.44	12.20	6,661,652	17,801,893	.....National Steel Corp.
84,664,566	144,288,797	0.78*	8.45	658,934*	12,190,649	....Youngstown Sheet & Tube Co.
70,441,606	114,857,600	1.86*	7.17	1,307,880*	8,231,335	.....American Rolling Mill Co.
74,058,924	110,744,037	6.64	11.44	4,916,203	12,665,317	.....Inland Steel Co.
62,420,280	90,455,381	0.79	4.69	493,138	4,238,488	.....Wheeling Steel Corp.
17,200,574	28,164,560	9.79*	2.53	1,683,520*	711,990	.....Colorado Fuel & Iron Co.
29,125,598	59,852,703	7.68*	6.71	2,237,026*	4,017,931	.....Crucible Steel Co. of America
13,718,500	31,989,204	0.90*	7.22	1,230,297*	2,320,031	.....Otis Steel Co.
20,827,882	32,745,296	3.74*	2.01	778,509*	657,272	.....Pittsburgh Steel Co.
11,597,016	19,356,892	2.49*	0.82	288,505*	158,218	.....Lukens Steel Co.‡
18,261,231	36,573,418	5.86*	4.96	1,070,186*	1,813,707	...Allegheny Ludlum Steel Corp.§
10,505,879	20,206,115	0.91*	6.65	95,325*	1,345,810	.....Sharon Steel Corp.
6,359,472	13,234,442	5.19*	1.92	330,231*	254,225	.....Granite City Steel Co.
12,801,105	19,723,904	4.94	4.13	632,865	814,553	.....Continental Steel Corp.
.....	.....	....	....	1,244,210	1,341,816	.....Midvale Co.
9,648,839	12,163,667	7.54	9.54	727,543	1,160,857	.....Keystone Steel & Wire Co.*†
.....	.....	....	....	331,849	445,729	.....Laclede Steel Co.
2,348,298	4,193,461	3.45	17.00	81,110	713,139	.....Rustless Iron & Steel Corp.
$1,015,773,603	**$1,670,958,840**	**0.47%***	**6.87%**	$10,936,841*	$211,479,861	.....Totals

l Assets	Current Assets		Current Liabilities		
1937	1938	1937	1938	1937	
$1,918,729,289	$510,338,510	$480,737,120	$79,261,329	$117,331,071	.....United States Steel Corp.
715,809,795	180,314,698	189,097,106	37,503,801	47,217,737	.....Bethlehem Steel Corp.
364,658,739	89,566,244	93,254,096	11,437,304	16,782,839	.....Republic Steel Corp.
219,642,737	62,464,373	53,162,448	10,804,642	15,004,422	....Jones & Laughlin Steel Corp.†
204,452,622	50,415,376	54,773,881	12,877,932	20,611,576	.....National Steel Corp.
220,641,266	93,579,879	74,650,237	10,204,878	17,445,737	....Youngstown Sheet & Tube Co.
145,844,560	49,828,914	59,090,612	8,080,000	10,442,154	.....American Rolling Mill Co.
158,326,380	48,140,364	52,327,198	7,686,331	10,056,137	.....Inland Steel Co.
123,551,253	40,463,915	44,028,183	6,386,215	10,663,727	.....Wheeling Steel Corp.
39,782,425	11,862,276	13,072,813	2,611,030	2,541,315	.....Colorado Fuel & Iron Co.
109,824,259	21,557,915	21,786,516	2,757,155	5,741,417	.....Crucible Steel Co. of America
39,025,847	9,950,907	12,126,457	1,696,576	2,188,085	.....Otis Steel Co.
41,302,682	14,005,671	14,273,566	3,835,469	3,493,572	.....Pittsburgh Steel Co.
15,692,169	3,150,037	5,169,811	2,477,513	4,586,616	.....Lukens Steel Co.‡
20,794,595	12,311,837	7,815,471	3,201,606	1,771,987	...Allegheny Ludlum Steel Corp.§
17,343,286	7,344,830	6,185,691	1,543,212	1,194,586	.....Sharon Steel Corp.
14,839,614	4,054,401	4,179,327	1,528,930	1,164,331	.....Granite City Steel Co.
14,229,675	6,531,463	6,124,874	1,217,061	909,925	.....Continental Steel Corp.
14,324,616	8,048,354	7,193,314	1,486,005	1,390,950	.....Midvale Co.
10,678,393	4,172,703	4,494,219	823,503	1,113,743	.....Keystone Steel & Wire Co.*†
7,113,276	3,133,856	2,833,629	419,382	1,176,578	.....Laclede Steel Co.
3,498,379	1,527,160	1,417,064	517,791	342,085	.....Rustless Iron & Steel Corp.
$4,420,105,857	$1,232,763,683	$1,207,793,633	$208,357,665	$293,170,590	.....Totals

The BUSINESS TREND

Activity Index Drifts To Lower Levels

■ REFLECTING the minor variations in industrial activity throughout the first quarter, STEEL's weekly index averaged 91.1 in January, eased slightly to 90.8 in February and advanced to 92.6 during March. The peak in the monthly average last year, 95.9, was recorded during November.

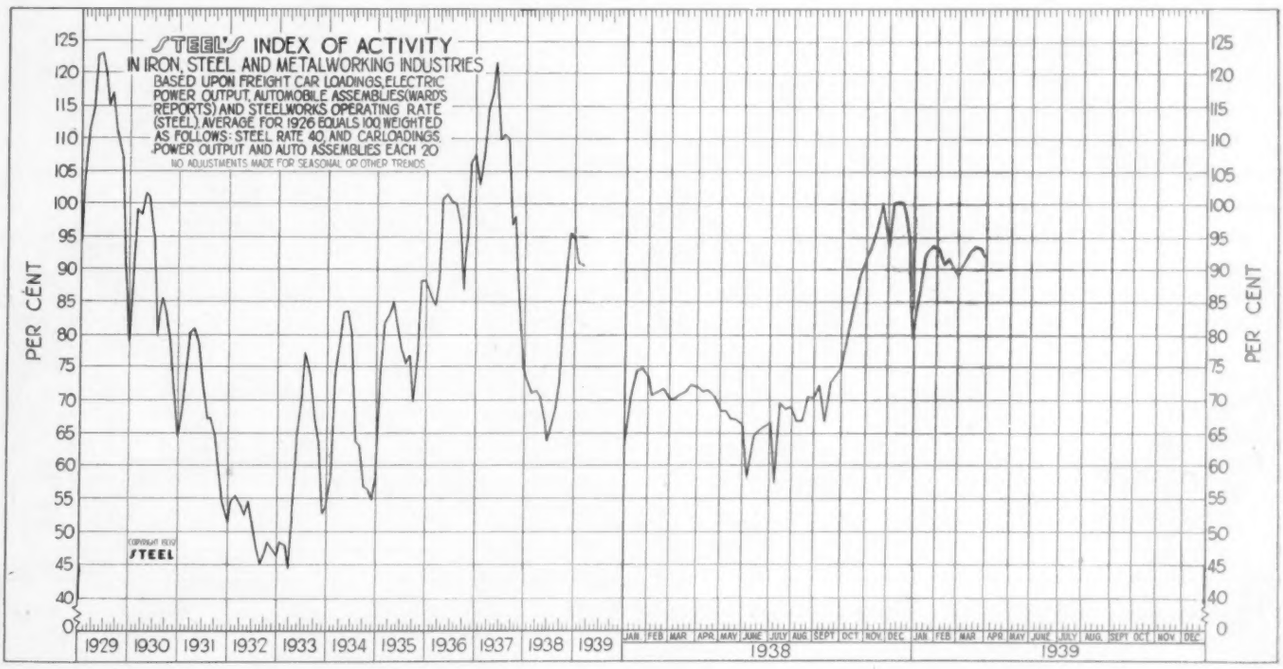
The index average of 91.5 for the first quarter was substantially above the 71.9 average in the initial quarter last year, and compares with the average of 94.9 for the final three months of 1938.

Industrial activity in the iron steel and metalworking industries, as registered by STEEL's index, declined in the week ended April 1 to 92.2, off 1 point from the preceding week. In the same week last year the index was 72.

Normally at this time a seasonal rise in the industrial indicators may be expected. Despite failure of industrial activity to expand in recent weeks, underlying forces of recovery seem well supported and no marked decline is expected.

Typifying the general hesitancy of industrial activity, steelmaking operations dropped in the week ended April 1 to 54.5 per cent. This is 2 points below the peak this year, registered in the weeks ended March 11 and 18. At this time last year the national steel rate, at 36 per cent, had reached the high point in the spring upturn.

Decision of automotive interests to even up field



STEEL'S index of activity declined 1 point to 92.2 per cent in the week ended April 1:

Week ending	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929
Jan. 7	86.5	70.1	107.8	90.2	65.4	53.6	45.3	55.8	69.2	88.1	94.8
Jan. 14	91.9	74.4	106.7	89.3	73.8	58.1	48.6	56.2	72.1	91.8	104.2
Jan. 21	93.0	74.7	104.0	86.0	78.1	60.9	49.8	55.8	72.9	96.3	107.5
Jan. 28	92.9	73.8	99.6	86.5	79.5	62.3	50.8	56.2	72.9	97.4	109.8
Feb. 4	90.7	70.9	100.8	83.8	81.8	66.9	49.9	56.0	74.9	100.8	111.3
Feb. 11	92.1	71.2	101.9	85.9	82.7	70.7	48.7	55.5	75.4	100.9	111.7
Feb. 18	91.1	71.9	108.8	81.8	82.8	72.4	48.3	54.5	76.0	97.7	112.6
Feb. 25	89.3	70.3	112.8	83.4	80.5	75.5	46.0	55.1	75.8	99.7	109.2
Mar. 4	91.5	70.1	117.9	87.7	81.1	76.8	47.4	54.1	79.2	98.3	113.5
Mar. 11	92.7	70.8	112.7	89.7	82.0	78.6	43.4	54.8	80.6	97.5	114.8
Mar. 18	93.3	71.3	113.1	86.0	84.0	79.9	42.7	54.4	81.3	98.1	115.0
Mar. 25	93.2	72.4	114.0	91.2	84.0	79.7	44.6	53.5	80.6	99.6	115.0
Apr. 1	92.2	72.0	112.0	96.8	84.3	79.3	45.2	53.4	81.5	97.6	115.9

stocks and await the immediate sales developments resulted in a temporary decline in automotive assemblies during the week ended April 1. Output slackened to 85,980 units, from 89,400 in the preceding week. In the comparable week last year 57,500 units were produced. Early estimate for March indicates motorcar sales aggregated 305,000 units against 196,000 in February. This is somewhat below the normal seasonal rise. Automobile production during March is estimated at 382,000 units, compared with 312,141 in February, and 238,598 in March last year.

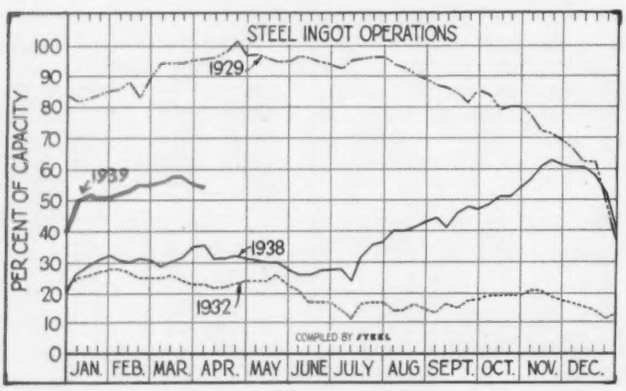
EXPORT BALANCE INCREASES SHARPLY

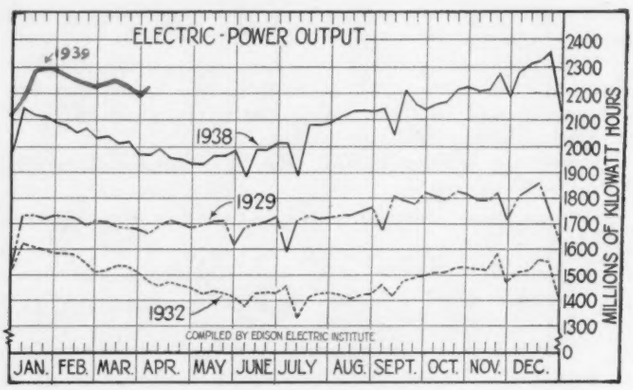
Reflecting trends in imports and exports during February, the export balance of trade rose to $60,524,000, from $34,708,000 in January. However, a year ago the export balance was much higher, at $98,984,000. Exports increased contra-seasonally during February, but this is offset somewhat by the abnormal decline registered in January from the December level. Imports declined sharply in February, whereas the seasonal expectation is for a slight decrease in the month. As a result February imports were at the lowest level since July, 1938. Exports in February amounted to $218,559,000, against $212,909,000 in January and $261,935,000 in February, 1938. February imports of $158,035,000 compared with $178,201,000 in January and $162,951,000 in February last year.

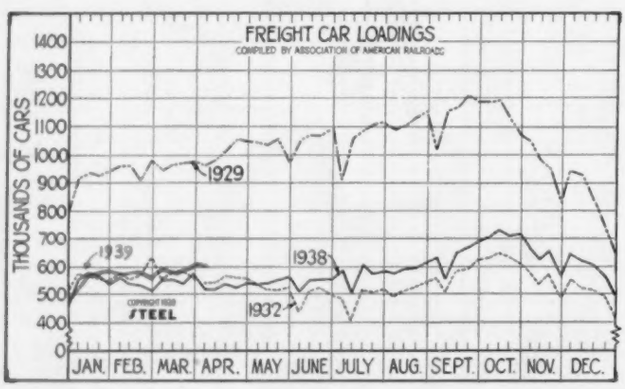
Following the general trend, exports and imports of steel and iron products in February receded from the January volume. Excluding scrap, February exports totaled 134,777 gross tons with a valuation of $9,772,707. This represents a decline of 11 tons in volume and $441,840 in value from January. Scrap exports during February were also lower 224,913, compared with 227,884 in January, and 356,790 tons in February, 1938. Imports in February, excluding scrap, declined 27 per cent in volume from the January total to 17,736 gross tons valued at $1,236,673. Scrap imports during February were lower at 1413 tons, compared with 3333 tons in January.

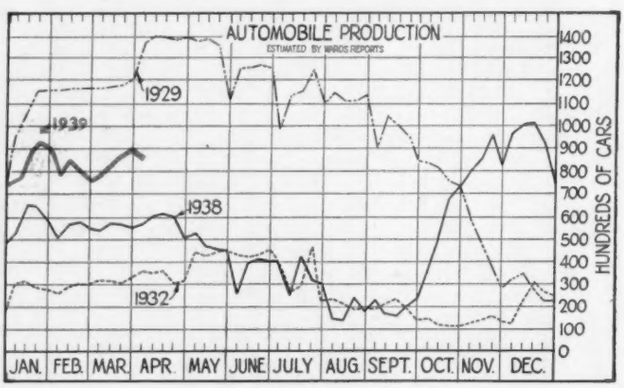
MARCH IRON OUTPUT UP 4.9 PER CENT

Average daily coke pig iron production in the United States during March amounted to 77,182 gross tons, a substantial gain over the February rate of 73,578 tons. The daily rate during February was the highest since October, 1937, with 93,259 tons. In March last year daily output averaged 47,426 tons. Active stacks on March 31 numbered 123, compared with 121 on February 28.



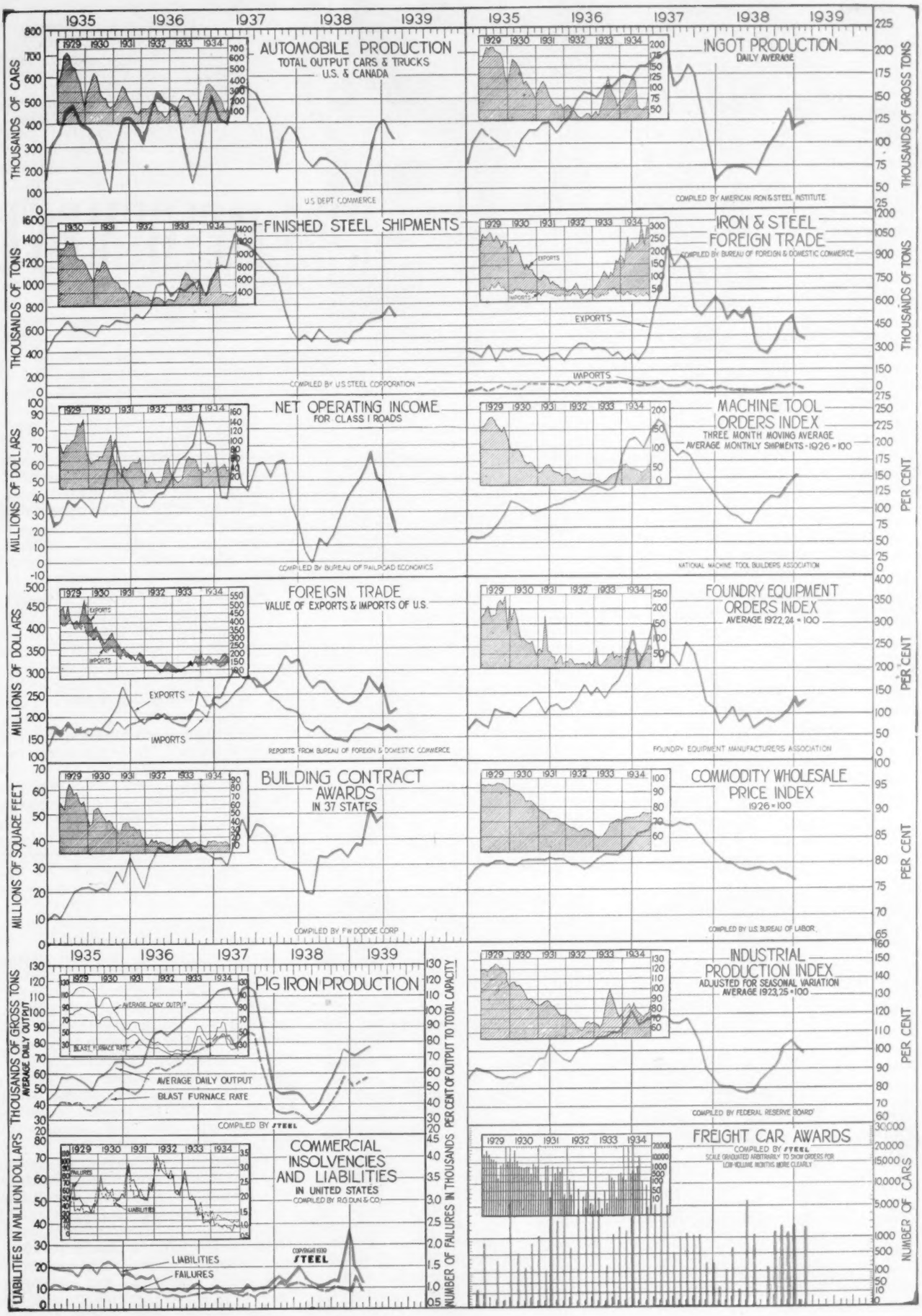




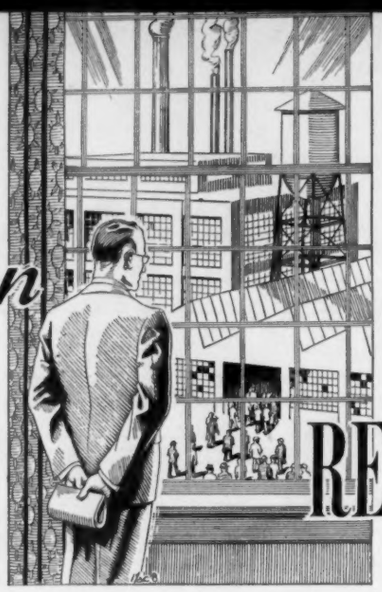


Week ending	Steelworks Operating Rate Per Cent 1938	1932	1929	Electric Power Output Million KWH 1938	1932	1929	Freight Car Loadings Thousands of Cars 1938	1932	1929	Weekly Auto Output 1938	1932	1929
Dec. 24	52.0	12.0	63.5	2,362	1,554	1,860	574	495	843	92,890	27,396	23,216
Dec. 31	40.0	13.0	38.5	2,120	1,415	1,638	500	407	638	75,215	25,598	23,967

Week ending	1939	1938	1932	1929	1939	1938	1932	1929	1939	1938	1932	1929	1939	1938	1932	1929
Jan. 7	51.5	26.0	25.0	84.0	2,169	2,139	1,619	1,542	531	552	573	799	76,685	54,084	30,755	75,000
Jan. 14	52.0	29.0	26.0	82.0	2,269	2,115	1,602	1,734	587	580	572	914	86,925	65,735	31,416	95,000
Jan. 21	51.5	30.5	27.0	83.0	2,289	2,108	1,598	1,737	590	570	562	932	90,205	65,418	29,365	105,000
Jan. 28	51.5	33.0	28.5	84.0	2,292	2,098	1,588	1,717	594	553	560	926	89,200	59,365	28,950	115,000
Feb. 4	53.0	31.0	28.5	85.0	2,287	2,082	1,588	1,728	577	564	575	947	79,410	51,443	27,110	116,000
Feb. 11	54.0	30.0	27.0	86.0	2,268	2,052	1,578	1,726	580	543	562	956	84,500	57,810	29,320	116,000
Feb. 18	55.0	31.0	25.0	88.0	2,249	2,059	1,545	1,718	580	536	572	958	79,860	59,100	30,410	116,500
Feb. 25	55.0	30.5	25.0	83.0	2,226	2,031	1,512	1,699	561	512	636	907	75,660	56,977	30,150	116,500
Mar. 4	56 0	29.5	25.0	89.5	2,244	2,036	1,519	1,707	599	553	560	977	78,705	54,440	31,390	116,500
Mar. 11	56 5	30.0	25.5	94.5	2,238	2,015	1,538	1,703	592	557	575	946	84,095	57,438	31,110	116,500
Mar. 18	56.5	32.0	24.5	94.5	2,225	2,018	1,537	1,687	594	540	585	958	86,725	57,558	30,590	117,000
Mar. 25	55.5	35.0	23.0	94.5	2,199	1,975	1,514	1,683	605	573	561	961	89,400	56,800	32,892	117.500
Apr. 1	54.5	36.0	23.0	95.0	1,210	1,979	1,480	1,660	604	523	545	967	85,980	57,500	35,756	120,000


AUTOMOBILE PRODUCTION
TOTAL OUTPUT CARS & TRUCKS U.S. & CANADA
U.S. DEPT. COMMERCE
INGOT PRODUCTION
DAILY AVERAGE
COMPILED BY AMERICAN IRON & STEEL INSTITUTE
FINISHED STEEL SHIPMENTS
COMPILED BY U.S. STEEL CORPORATION
IRON & STEEL FOREIGN TRADE
COMPILED BY BUREAU OF FOREIGN & DOMESTIC COMMERCE
EXPORTS
IMPORTS
NET OPERATING INCOME
FOR CLASS I ROADS
COMPILED BY BUREAU OF RAILROAD ECONOMICS
MACHINE TOOL ORDERS INDEX
THREE MONTH MOVING AVERAGE
AVERAGE MONTHLY SHIPMENTS - 1926 = 100
NATIONAL MACHINE TOOL BUILDERS ASSOCIATION
FOREIGN TRADE
VALUE OF EXPORTS & IMPORTS OF U.S.
REPORTS FROM BUREAU OF FOREIGN & DOMESTIC COMMERCE
FOUNDRY EQUIPMENT ORDERS INDEX
AVERAGE 1922-24 = 100
FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION
BUILDING CONTRACT AWARDS IN 37 STATES
COMPILED BY F.W. DODGE CORP.
COMMODITY WHOLESALE PRICE INDEX
1926 = 100
COMPILED BY U.S. BUREAU OF LABOR
PIG IRON PRODUCTION
AVERAGE DAILY OUTPUT
BLAST FURNACE RATE
COMPILED BY STEEL
INDUSTRIAL PRODUCTION INDEX
ADJUSTED FOR SEASONAL VARIATION
AVERAGE 1923-25 = 100
COMPILED BY FEDERAL RESERVE BOARD
COMMERCIAL INSOLVENCIES AND LIABILITIES
IN UNITED STATES
COMPILED BY R.G. DUN & CO.
LIABILITIES
FAILURES
COPYRIGHT 1939 STEEL
FREIGHT CAR AWARDS
COMPILED BY STEEL
SCALE GRADUATED ARBITRARILY TO SHOW ORDERS FOR LOW-VOLUME MONTHS MORE CLEARLY
THOUSANDS OF CARS
THOUSANDS OF TONS
THOUSANDS OF GROSS TONS
MILLIONS OF DOLLARS
MILLIONS OF SQUARE FEET
PER CENT
NUMBER OF CARS
LIABILITIES IN MILLION DOLLARS
NUMBER OF FAILURES IN THOUSANDS
PER CENT OF OUTPUT TO TOTAL CAPACITY

Forum on RE-EMPLOYMENT



■ WHAT TO DO about unemployment, pending changes in economic policies which seem to be hindering recovery, is the theme of this week's Forum contribution.

According to the author, the answer lies in the development of new products, and he cites as proof the recent achievements of several well-known companies which have entered actively into new product development.

Charles H. Oppenheimer is especially well fitted to the discussion of this subject, being president of Designers for Industry, Inc., a product development consulting organization with offices in New York, Cleveland and Chicago. He was graduated from the University of Pennsylvania; served as planning engineer with the Goodyear Tire & Rubber Co., Alexandria Aircraft Corp., and at the Naval Aircraft factory in Philadelphia; and was vice president of Enterprise Electric Lighting Fixtures, Inc. in Cleveland.

Mr. Oppenheimer says: "New products and the training of workers to make them will—I believe—solve the problem of unemployment. What a few industries have accomplished in increasing sales, employment and profits during 1938, can be duplicated by thousands of others if the proper steps are taken in a scientific and thorough manner.

—The Editors

■ IN THIS Forum, the various causes of unemployment have been dealt with in detail, but business men generally would seem to be agreed that New Deal policies are cause No. 1.

What to do about it, pending changes in these policies, is most important to millions of people in this country—and perhaps even more important to business. That some businesses definitely are doing something about it is verified by the fact that last year nearly $300,000,000 was spent in industrial research alone. Over 1700 companies maintained organized laboratories with a personnel of 32,000 trained men.

Over 1000 of these laboratories have been started since 1920. They are spread unevenly over industry, half of the research workers being confined to only seven industries. What are the other 345 separate industries doing? Are the older industries going to allow the new ones to take their markets? While it is true that many companies could not possibly afford a large research department, it is good business insurance for them to spend some money either within their own organization or with an outside service organization.

That such work produces tangible results is indicated by the fact that of the 1937 sales of du Pont, 40 per cent were from new lines developed within the last ten years; of Armstrong Cork, 24 per cent from new products developed within the last seven years; of Johns-Manville, 43 per cent from products either new or improved within the last ten years. General Electric reported that about 60 per cent of their products were unknown in their line ten years ago. Without these new products these companies would not today be employing the number of men they are.

Chicago Flexible Shaft Co. reported a net profit of $1,683,763 for 1938, as compared with a net profit of $1,120,947 in 1937. Much of this gain can be attributed to the introduction of a new product, the Shavemaster electric razor. Polaroid Corp., Boston, Mass., reports that during the year, 1938, employes were increased in number by approximately 100 per cent due to the introduction in April of the Polaroid desk lamp; in June, the Polaroid glass-inspection polariscope; in July, Polaroid sight-conditioning windows (first installation on the Union Pacific streamliner "City of Los Angeles") and in December, Polaroid day glasses.

One of the largest air-conditioning equipment manufacturers reports a net increase of 10 per cent in his payroll for 1938 due to new products introduced in the months of March and June, resulting in a net volume of over $700,000 in increased business for the year. In May, 1938, the Detrola Corp. placed new "peewee" radios on the market, resulting in an increase of 25 per cent in total volume for the year with approximately the same increase in employment.

Diebold Safe & Lock Co., Canton, O., is one of the old-line companies not satisfied to wait for political changes. Instead, it forged ahead with the introduction of the Rush-hour depository in January, 1938; the Eldoorobe in April; sectional-drawer visible file and reference panels in May; the Invalift, and the Cardineer and Reveldex record sys-

tems in September. These not only represent new products but diversification as well, even to the extent of going into lines that did not fall in the old sales channels.

Obviously it is impossible to recite all of the new products introduced during 1938, some of which did not get on the market in time for an accurate forecast of sales. Of the 166,000 manufacturers in this country, many did not introduce any new products or improvements on their present products during 1938. It is to these manufacturers in particular that I address this message, for they are in many cases not building for the future and not placing themselves in position to employ more people.

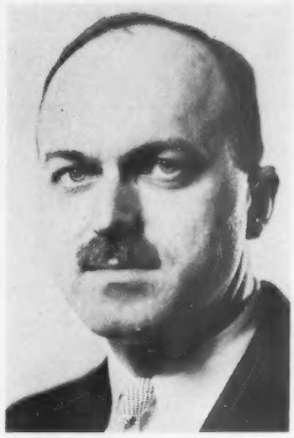
Out of many new things which will be proposed to you only a small percentage are likely to be successful. If you have tried getting a new product and it has not turned out well, examine closely the entire transaction and you will usually find that you failed to consider one or more vital facts. One of the first things you must be sure of is: "Will it fit into the organization? Is it the type of product that the present personnel can interest themselves in to the fullest extent? Will they 'live' with this product?"

Determining Affinity

One of the factors that determines the "affinity" of one product for another is similarity of prime cost or the relation of total direct labor and material to selling price. It indicates a similarity in basic thinking as required for profitable operation. Type of plant and equipment are naturally important but rarely as important as some intangibles like the experience of the management and of the factory personnel, its skill and mental equipment, the "know how" of the organization, or the contacts and markets with which the sales department is familiar. It is only after a thorough inventory is taken of these hidden assets that it is possible to look effectively for anything—or what is more important—to recognize it when it is located.

We have found that an outside viewpoint—a combination of vision and organizing ability, a combination of engineering and sales training, a concentration of time and energy on the task—is productive of straight thinking. You can not be too thorough in the initial work of plotting the project and its limitations; utilizing industrial engineers for plant and equipment information, merchandisers for market and sales channels investigations, and all the contacts available with manufacturers, laboratories and invention groups both in this country and abroad.

When a product seems to have all of the factors that are required for your conditions, do not spend money on its development until you first investigate. Market research, when in competent hands, is worth more than it costs in every case. It will reveal the possible market, the right prices class, the right design, etc. With this information at hand, you are in position to make a sound decision, and on the basis of this information, to develop a product that will receive favorable buyer reaction.



Chas. H. Oppenheimer
President
Designers for Industry, Inc.,
New York

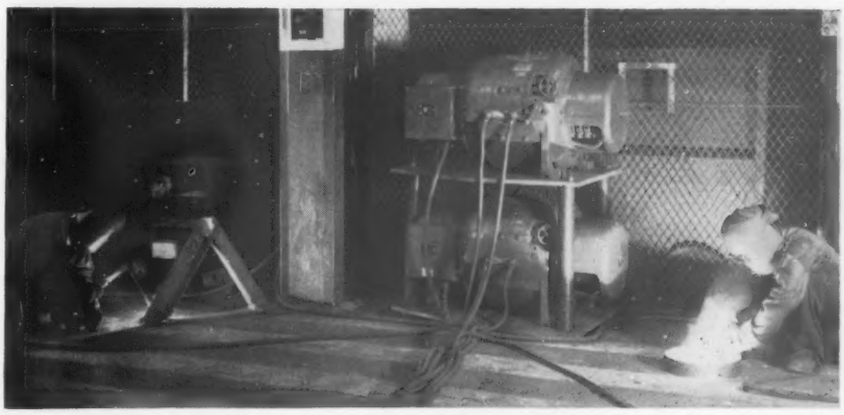
It is possible to find new products in a scientific way. New products will assist in increasing or holding the volume of business required, or in replacing business that is no longer profitable. New products can be an asset to steady employment by diversification of production. New products are not necessarily radically new in the sense that they have never been made. It is quite possible to reach an entirely new market with a product already established, by introducing new devices, new utility or new methods that greatly reduce costs.

In the development of new products many a concern has in the course of time developed an entirely new business, employing a complete staff and many employes separate and apart from the previous business of the company. This in turn may even lead to the establishment of an entirely new industry with plants throughout the country, each one employing a large number of men and women. The growth and profits of such businesses are quite apt to be better than of old industries.

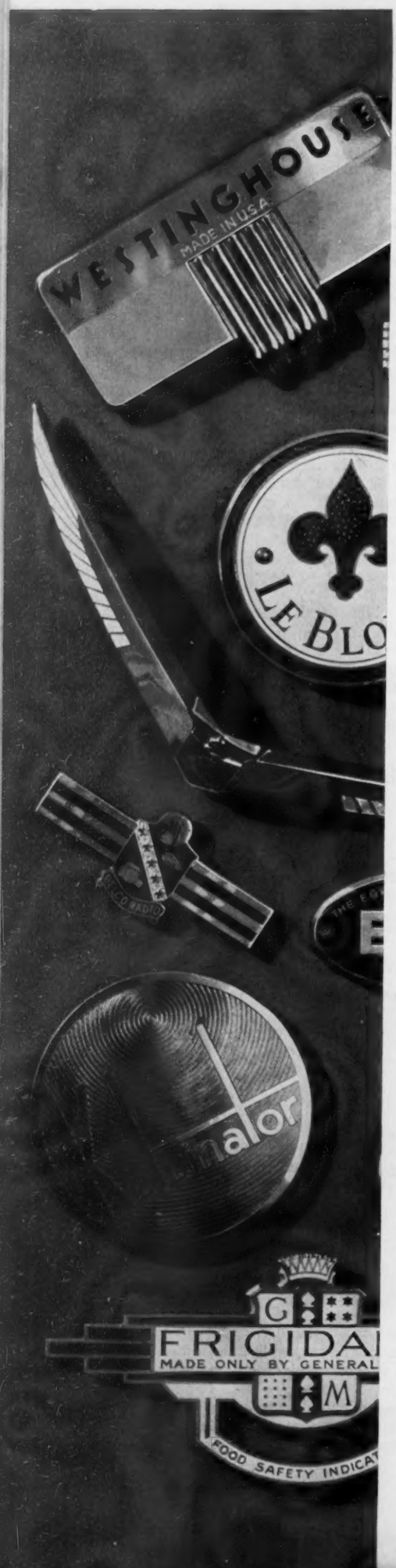
The wants of people are limitless and their ability to buy was never more in evidence than it is now. The newly employed will help the old industries and the old industries will help the new. The whole thing hinges on the creation of new products that are needed by the public or which can be sold because they give greater utility, greater convenience or increase the efficiency of industry.

New products and the training of workers to make and sell them will—I believe—solve the problem of unemployment. What a few industries have accomplished in increasing sales, employment and profits during 1938, can be duplicated by thousands of others if the proper steps are taken in a scientific and thorough manner. If each of the 166,000 manufacturers would add one new product, each would employ an average of 30 new people. Service industries would then absorb the balance and so the problem of unemployment would disappear.

Double Welder Mounting Saves Space



■ **Mounting one single-operator welding set above another, as shown above, has been found to be a simple means of cutting floor space requirements and maintaining an orderly welding section. Stand on which machines are mounted is easily fabricated from steel plates 1-inch thick, some 3-inch pipe and through-bolts. It may be placed adjacent to a wall or between operators, eliminating a confusion of single machines about the welding floor. Photo courtesy Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.**



Nameplates With Sales A

Production of decorative metal parts combines intricate stamping and forming operations with interesting finishing techniques. Many portions are inlaid with highly colored enamels; both synthetic and vitreous types used

By **FRANK FOX**
Fox Company
Cincinnati

■ MANUFACTURERS of automobiles, refrigerators, stoves, machinery, household appliances, radios and other products are making extensive use of escutcheons, nameplates and decorative metal parts to increase the merchandising appeal of their products. Such parts are made of nonferrous metals as well as cold-rolled or stainless steels.

These articles are of three different types. They may be embossed and beautifully finished in chrome, inlaid with baked or synthetic enamels, or inlaid with lustrous colorful vitreous enamels.

Vitreous enameled products are much in demand due to their eye-appealing beauty and to their immunity from heat, cold, acids and the elements. The metal from which these articles are embossed is a special bronze consisting of 9 per cent copper and 10 per cent zinc.

First operation in their manufacture is to make the stampings. These are either simple or complicated shapes—flat, modeled or with radii. In the first operation the metal is blanked, after which the blanks are fed into stamping dies that emboss the intricate designs.

To bring out fine details, these stampings may be embossed several times. They usually are annealed between the stamping operations. After each annealing, stampings are treated in acids to remove the scale and oxides.

Stampings now are trimmed, perforated and formed. The size of the article determines the type of press and tonnage needed for fabrication. Every variety of press is employed from the smallest power presses to huge, straight side, embossing presses; toggle or percussion presses; and forging hammers with pressures up to 1000 tons.

Dies and tools necessary for manufacturing these pieces are made accurately from blueprints furnished by the buyer or from sketches of the proposed products. Embossing dies may be cut by hand, or in pantograph or duplicating machines, while the tools are made in the newest type equipment at high speed.

Attachments Added

When stampings are completed, attachments such as studs, springs, trimount fasteners, pins or speed nut pins are fastened to the rear. These attachments are silver soldered at 1200 degrees Fahr. either in automatic furnaces or with hand torches. Whenever possible, these devices are spun or fabricated in the rear. Soldering is done with a mixture of hydrogen and oxygen which makes a fine bond without melting the articles.

From the assembling department, articles move to the enameling division. Those plates to be inlaid with

s Appeal

synthetic enamels go to a dust free, air conditioned, spraying department. Synthetic enamels are sprayed through perfectly fitting templates and masks. These materials then are baked carefully in electrically controlled conveying ovens which are automatically held at exact temperatures. After this, the enamels are highly polished and buffed.

Enamels Inlaid

Those articles to be inlaid with vitreous enamels are first sent to the cleaning department where the most minute particle of scale and oxides must be removed carefully. Acids and other cleaning compounds are used for this work. Vitreous enamels employed for this process are made largely in America, but some few colors are imported from various sections of the world. These enamels, free from clay and foreign substances, are ground to exacting meshes.

Vitreous enamels are inlaid by various methods. Some are sprayed through templets and masks. Others are sifted onto the work. Some are filled in the depressed portions by hand, using small spatulas.

After the enamel is inlaid, the articles are preheated. This is followed by firing at 1200 degrees Fahr. in automatically controlled, continuous, conveyor type furnaces. To compensate for distortion caused by the tremendous heat, the plates are preformed to fantastic shapes so that the firing causes the plates to return to their proper radii.

At times it is necessary to inlay a single color, fire it, then repeat the operations with each successive color. This is necessary especially when using dainty pastel shades or transparent colors.

After the firing operation, the surplus enamel is ground "flush" with

Mesh belt takes work through continuous enameling and annealing ovens like this at the Fox plant

the metal portions. This grinding may be done by hand or mechanically. It usually requires several different size grits in grinding wheels so final grinding will leave the enamel and metal portions quite smooth.

Articles now receive a second firing. After scale and oxides have been removed, they are taken to the pumice division where high speed felt wheels, charged with various grades of pumice, add luster to the enamels and remove grinding marks from the metal portions. Following the vitreous enameling operations, the work is moved to the buffing and coloring departments where the plates receive a mirror finish.

The products now move to the plating division where they are sent through degreasers or hand scrubbed in cleaners to remove the polishing compound, making them chemically clean and ready for electroplating. Any number of finishes are available in the plating department including brass, bronze, oxidized nickel, chromium, silver and gold.

The most popular finish is bright chromium. To secure this finish, the articles are first plated with a 0.00025-inch thickness of nickel. Then they are plated with a 0.00015-inch thickness of chromium.

Extremely strict control is necessary in the plating as well as the enameling and cleaning divisions. A chemist and a modern laboratory are provided to establish and check correct procedure. A number of nameplates, escutcheons and decorative metal parts made by Fox Co. are shown in accompanying views. These indicate the wide variety of sizes, types, shapes and materials involved.

The new plant just recently completed contains approximately 100,000 square feet floor area and has more than 100 presses, several hundred polishing lathes, many large plating tanks, dozens of furnaces, a large number of soldering torches and new equipment of every description. Also there are several new, conveyor type, electrically controlled, heating ovens, one of which is shown in an accompanying illustration.

More than 500 artisans produce some 50,000 pieces daily. Work is moved throughout the plant on conveyors wherever possible. Shipped to all parts of the world, these products add sales appeal to many items.

•

Thin Enamel Coatings Have High Opacity

■ Described as ultra-opaque sheet iron cover coats and designated as Ultrapaque No. 1313, a new line of porcelain enamels has been developed by Ferro Enamel Corp., Cleveland. It is said these enamels are applied in a coating 40 per cent thinner than that required with ordinary enamels with no loss in opacity or covering power. Other advantages claimed are increased resistance to mechanical shock, deflections and scratching, and the production of enameled sheets that shear neatly with no chipping back from the edges.

This type of enamel is supplied in powdered form. In the enameling plant it is necessary only to add water to this powder in the mill and then grind to a dry residue of about 1 gram on a 325-mesh sieve. Because of its fine particle size, this type of enamel is said to spray more easily, stay in suspension more readily and cause less wear on spray equipment than more coarsely milled porcelain enamels. It fires at slightly lower temperatures than standard cover coats but otherwise can be handled in the usual way.

Contribute to Technique Of Enameling Metals

■ In order to clear up some uncertainties as to the cause for failure of enameled ironware due to differential contraction between the enamel and the iron base, W. N. Harrison, B. J. Sweo and S. M. Shelton of the bureau of standards, Washington, recently conducted a series of experiments.

After studying the behavior of a large number of ground-coat enamels during heating and cooling cycles, they derived constants for each one which, when substituted in simple first-order equations, permit computation of the expansivity of each frit at any stated temperature or in any temperature interval between 77 degrees Fahr. and the critical temperature.

Handbook of Welding By German Authority

■ *Practical Handbook of the Entire Welding Technique* (Praktisches Handbuch der gesamten Schweisstechnik), by Schimple-Horn; fabrikoid, 300 pages, 6 x 9 inches; published by Julius Springer, Berlin, Germany; supplied by STEEL, Cleveland; in Europe by Penton Publishing Co. Ltd., Caxton House, Westminster, London, S. W.1.

This book, which is in German, is the third edition of Part I on the practical phase of welding technique, and is concerned with gas welding and cutting technique. It is divided into eight chapters of which the introduction discusses generalities of welding and gas welding, special new welding processes, review of arrangement of gas welding plants, and important properties of weldable metals. Chap. II deals with specific equipment for gas welding and describes welding gases, and welding accessories. Technique of gas welding is described in detail in Chap. III while soldering with a welding torch is covered in the next chapter. Torch cutting is dealt with in Chap. V, and the advantages of welding seams and their testing is described in Chap. VI. Chap. VII and VIII discuss capacities and costs of gas welding processes, and advancement of welding technique.

Pure Iron Powder

Direct Reduction from Ores and Scale at Low Temperature Nearing Long Sought Goal

Advances in powder metallurgy one phase of potential market in which rapid strides presage early erection of domestic plants for economical production of iron

By A. H. ALLEN
Detroit Editor, STEEL

■ QUICKENING of activity in the field of metal powders and a broader understanding of their metallurgy suggest a review of how powdered metals—especially iron—are prepared from their oxides, of the history and experimental work involved in these reduction processes, and of some latterly-perfected uses and future possibilities.

Separation of oxygen from metallic elements, as in the reduction of ores, usually involves the high temperatures of the blast furnace, open hearth and electric furnace. Perhaps nothing has stimulated advancing civilization to the extent that the development and utilization of high-temperature reduction methods have. But these high-temperature processes tolerate no selective reduction of metallic oxides; they are, in effect, "melting pots" and practically all of the reducible metallic oxides present, together with some of the nonmetallic oxides, may be found reduced and alloyed, wholly or partly, with each other. The problem of metals separation, or metals elimination then becomes important, if the production of a single, pure metal is the aim.

Low-temperature reduction results in selective reduction of certain metallic oxides present in nearly every commercial product, and this initial selectivity often brings a more effective separation of constituents than is possible when all the products are alloyed. This primary separation of the principal metal from other constituents is distinctively characteristic of low-temperature reduction.

In general, low-temperature reduction of metallic oxides is carried out at a temperature below the sintering point of the constituents of the charge and without addition of fluxes. Thus, if there is to be no fluxing action, other separation methods must be employed. These group themselves about as follows:

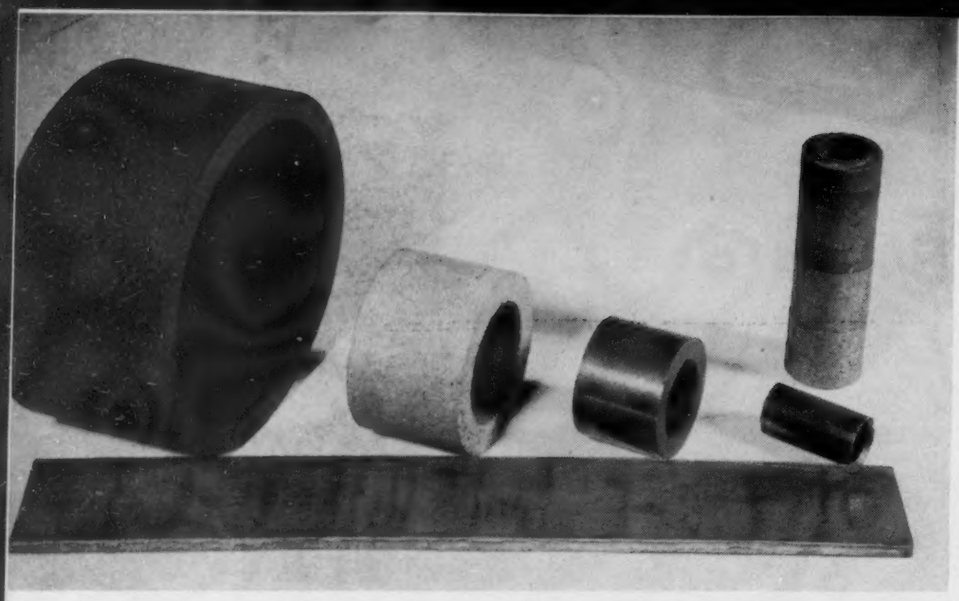
1. Magnetic separation	No heat involved
2. Gravity concentration	
3. Oil flotation	
4. Metallic vaporization during reduction	Heat added
5. Fusion of the "end" metal during reduction	

It should be stated that after steps (4) and (5) the metal or metals produced may be separated from each other and from gangue constituents by resort to (1), (2) or (3). It is also possible to produce certain metal powders by atomization and by electrodeposition, methods which are not considered in this discussion.

TECHNICAL literature, other than patents, on the subject of commercial production and use of powdered or sponge iron is sparse; yet metallurgists and engineers have "fooled" with the matter for a score of years or more. It appears that just now a number of important uses for powdered iron are being proposed, but with the supply limited largely to Swedish sources, progress is being stymied for economic reasons. Hence STEEL has undertaken to examine the historic ramifications behind research work in the development of commercial sponge iron production methods, and the possible outlets for the material. It is demonstrated that reduction of iron oxides by low-temperature processes, far from being a metallurgist's pipedream, may even now be on the threshold of an important new industry in this country.—The Editors.

Iron Oxide Reduction

For at least 20 years, investigators and research workers have been intrigued with the idea of producing iron without the aid of the blast furnace. Large sums of money and long years of labor have been expended to this end, without much practical success. Many experimenters have been obsessed with the delusion the goal was simple to attain, that their success was a foregone conclusion, that their rewards would be rich. Others were spurred on by an eagerness to "put the blast furnace out of business," and so feverish were their efforts



Samples of bushings and flat bar of "new iron" prepared by the Smith reduction method. Parts are formed by briquetting, sintering and sizing the pure iron powder

that they took on more the aspects of crusades than of studied research. Suffice to say, the day of the blast furnace still is far from drawing to a close, despite progress made in the direction of low-temperature reduction of iron ores.

The proclaimed purpose of most low-temperature reduction enthusiasts has been to obtain an iron with qualities superior to that produced by the blast furnace. By common usage this product has been termed sponge iron, a name probably derived from the physical characteristics of iron made by ancient methods practiced prior to the introduction of the blast furnace. Investigators are in substantial agreement that iron produced by low temperature reduction methods has qualities which make it superior to many products made from pig iron. But, the commercial success of a low-temperature reduction process and its product in this country have yet to be demonstrated.

Practical Method Near

Perhaps few persons are more qualified to speak with authority on the subject of sponge iron production than H. G. S. Anderson, now residing in Muskogee, Okla., and for 22 years almost continuously engaged in development and exploitation of processes and apparatus for low-temperature reduction of various metallic oxides, principally iron.

For this reason this editor of STEEL has visited with Mr. Anderson, watched his experiments with pilot plants in Oklahoma, and has reviewed extensively his work with and observations on sponge iron production. It appears, as a result of this investigational work, that Mr. Anderson now has a commercially practicable production method, awaiting only a sufficiently large and steady market for the product.

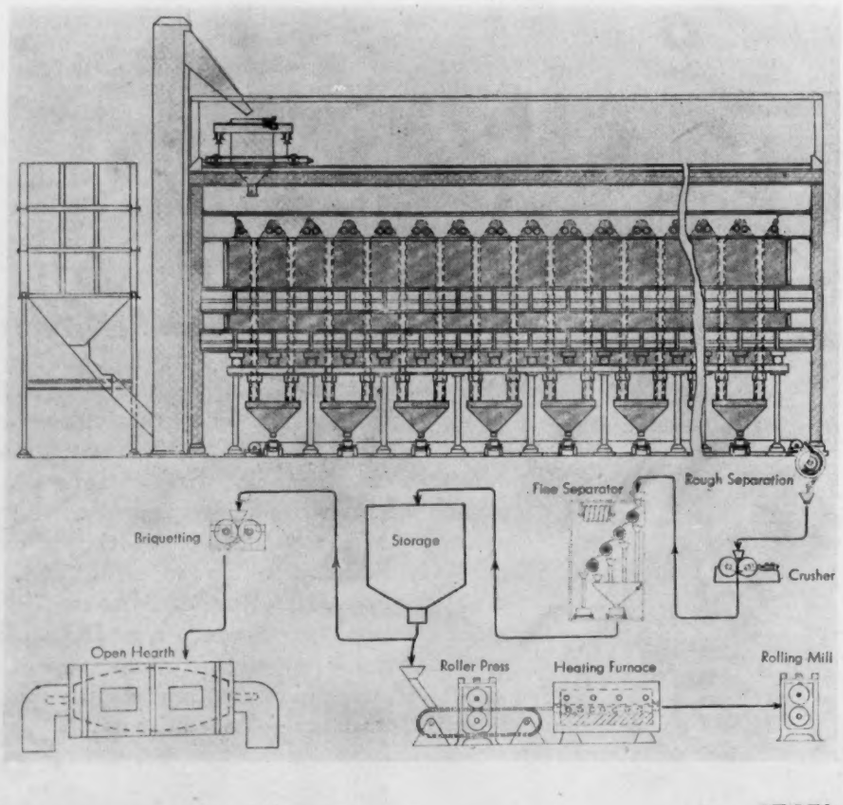
Foundation of Failures

Two decades of metallurgical pioneering in low-temperature reduction have witnessed a good many more failures than successes and, ironically, such success as has been achieved has been built upon a foundation of failures.

Going back to the beginning of the development, the need for a sponge iron or iron powder first was occasioned by the demand for a fine precipitant for copper from copper sulphate solution in the treatment of the mixed oxide-sulphide copper ores of the Chino Copper Co. in New Mexico. Now that most copper ores are of the sulphide variety this need has disappeared, but in the early leaching of copper ores a finely-divided iron was essential, and metallurgists discovered iron powder was not so readily obtainable in the open market as they had assumed.

Subsequent investigation disclosed a method long used by the Chinese to produce sponge iron. Fireclay retorts were filled with iron ore and coal, heated for a few days, allowed to cool to atmospheric temperature and then were broken open to obtain a spongy, sintered mass of iron, coke and gangue, obviously unsuited to provide a source of fine iron powder. Further search revealed a Swedish company also to be making sponge iron in fireclay pots. This interest used a high-grade finely crushed magnetic iron ore which was alternated with coal in layers until each pot was filled. The pots then were covered with fireclay lids and placed upon cars which passed through straight-line brick kilns, during which time the pots were heated to a reduction temperature. This process produced a better grade of sponge iron, not mixed with coal and containing little gangue, but the iron particles were welded together and required fine grinding if the iron were to be used as a copper precipitant.

These disclosures, made 20 odd years ago, left no path open but the



Iron ore reduction and processing plant of coke oven type proposed by the late William H. Smith. Chief difficulty with this unit was in accretions forming on the oven walls and bridging across them

one leading to development of a new process for reduction of iron oxides to obtain a pure iron powder. No preconceived ideas as to equipment were applied, and the work necessarily had to start from scratch.

Over a period of several years furnaces were built ranging in size from laboratory to semicommercial and commercial units. Each design was tested thoroughly to determine its commercial practicability, and before any design was abandoned a review of favorable and unfavorable aspects was prepared to avoid the same pitfalls in subsequent equipment. Types of furnaces erected and tested in this period included:

1. The by-product coke oven type.
2. The cylindrical rotary-kiln type.
3. The cylindrical steel tube, with internal transport screw.
4. Various resistance-type electric furnaces.
5. Rotary-hearth muffle furnaces.
   a. Circular hearth, heated with fuel burned in silicon carbide tubes.
   b. Annular hearth, heated with fuel burned in silicon carbide tubes.
   c. Circular hearth, heated with fuel burned above a silicon carbide tile arch sprung over the rotary hearth.
   d. Circular hearth, heated through silicon carbide tubes, and with reducing gas fed up through hearth.

It is of interest to review the results obtained with each of these units. The by-product coke oven type (1) involved ovens from 20 to 35 feet in height, built first of fireclay and later of silicon carbide. In each instance iron was produced, completely reduced, from iron ore and raw coal charged at the top of the retort and allowed to descend in the heated oven at proper rate of speed.

Accretions Formed

However, at no time during tests with these ovens, extending over many months, was it possible to keep the charge or iron ore and coal descending in the ovens longer than 12 hours without welding of the particles of iron and the formation of accretions on the sides of the ovens. At the point where reduction of the iron oxide was complete, the hot metallic iron always adhered to the sides of the oven, arresting descent of the charge and continuous production of the iron. Temperatures of the ovens were lowered, but accretions continued to form, although at a slower rate. As a result of the lower temperature, production was reduced to a point where it became patently too small for the capital investment.

Accretions on the walls of the oven gradually formed a "bridge" of hot, welded iron from wall to wall which always adhered so tenaciously that it was impossible to dislodge it without breaking the walls, after which it became necessary to cool the furnace, dismantle the oven and erect a new one.

Graphite Lining Helps

This welding of the iron particles in the oven was believed to result from the fact that during reduction from iron oxide, the iron swells to a greater volume than the original oxide. This volume increase, together with the pressure of the overlying charge, and the temperature of the hot iron, produces the incipient welding.

It was noticed that hot sponge iron, at the instant of reduction from the oxide, adhered to every solid substance, carbon excepted, with varying degrees of tenacity. This led to the decision to line the oven with graphite to prevent accretions, and to abandon the conventional rectangular cross section in favor of a circular cross section, because of the greater ease in fitting an annular section of graphite, 1 inch thick. The new retorts were of silicon carbide, 12 inches in diameter and 20 feet high.

A good grade of sponge iron was produced in this graphite-lined design for a period of one week, but at the end of the seventh day it was discovered the graphite lining had disappeared entirely at an elevation in the retort where maximum reduction of the oxide occurred. A bridge then formed across the silicon carbide retort and soon plugged it.

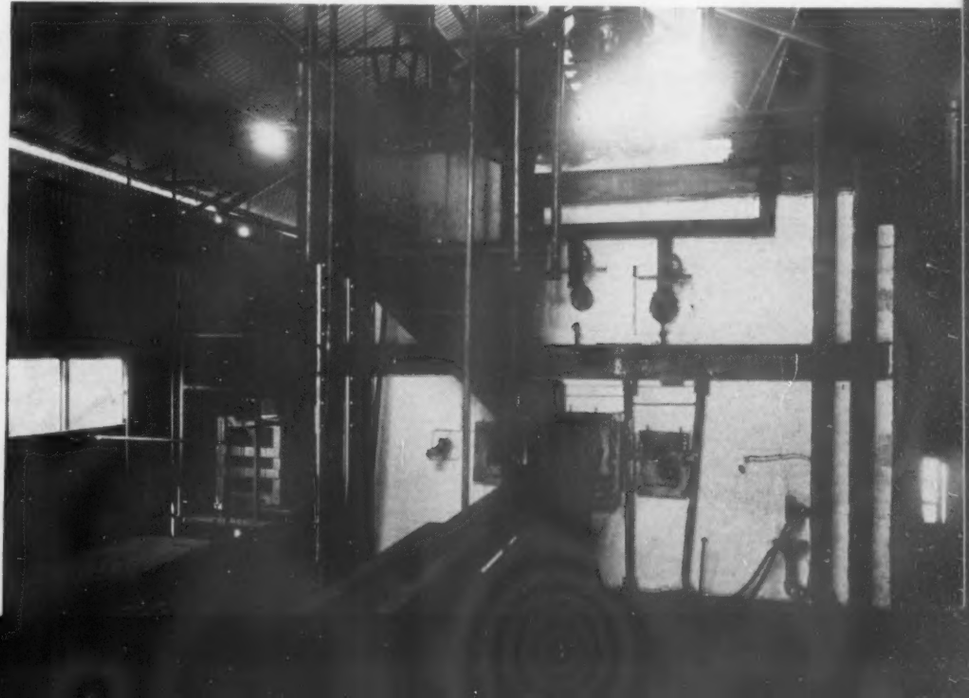
In this connection it is perhaps pertinent to make reference to work which the late William H. Smith did with this type of reduction unit. For a time connected with the automobile industry, he later supervised the erection of a reduction plant of the coke oven type at the Ford Motor Co., later dismantled. He claimed to be able to process an iron ore containing 38 per cent Fe into so-called "new iron" with only sufficient gangue remaining to satisfy the quantity of slag required in steelmaking, and practically free from gases, phosphorus and sulphur.

Later organizing the General Reduction Co., Detroit, Smith until his recent death was vociferous in promoting his reduction process. Results of Anderson's research with coke oven reduction units, possibly suggest why the Smith process never met commercial acceptance. Too, it appeared that Smith saw in his process a successor to the blast furnace, and despite his protestations that his ideas were being throttled by blast furnace operators concerned about their future, it is just not economically possible to consider low-temperature reduction methods in this category—yet. Smith, however, should be given credit for visioning the possibilities of production of parts from sponge iron by compressing and sintering.

Opposing Factors

Turning now to experiments with the cylindrical rotary kiln type furnace (2), the decision to experiment with this type of unit was influenced by the obviously simple design, the large production in other industrial applications, and the probable low capital cost per unit of daily output. But Anderson's research has convinced him that, in using the rotary kiln to produce sponge iron, the operator attempts to accomplish two diametrically opposite chemical reactions within the same chamber: (a) Combustion of the heating fuel, a highly oxidizing chemical reaction; and (b) reduction of iron oxide, a highly reducing chemical reaction.

As a result, the iron oxide never is completely reduced, or if it is re-



Front of dual rotary hearth (preheating and muffle hearths) furnace erected at Muskogee, Okla., for pilot plant testing purposes. Note stationary rabble arm which extends through the furnace and across the hearth, carrying silicon carbide rabble blades

duced, the iron is quickly reoxidized by air or carbon dioxide. The final result is the same—partly reduced iron oxide. Seventy-five per cent is said to be a high reduction and even this is difficult to maintain for any considerable length of time.

Citing results of rotary kiln experiments made in 1918: Heating fuel first was burned efficiently, resulting in maximum carbon dioxide content of heating gases. Sponge iron produced contained about 25 per cent metallic iron. Fuel oil burners then were adjusted to produce a reducing flame in which carbon monoxide would constitute a maximum percentage and carbon dioxide a minimum percentage of combustion gases. Reduction of iron improved until it was possible finally to obtain from 60 to 75 per cent metallic iron. The remaining 25 to 40 per cent was discharged as iron oxide—losses too large to permit operation within bounds of economy.

Crushing Necessary

The product discharged from the rotary kiln was a succession of agglomerations of fused and partly reduced sponge iron, magnetic iron oxide, nonmagnetic iron oxide, pieces of coke and gangue from the iron ore. These fused masses had to be crushed before the product could be submitted to magnetic separation. The final magnetic product consisted of 60 to 75 per cent metallic iron. the remainder being principally still adhering magnetic iron oxide and gangue, with some coke.

In later experiments with the muffle-type furnace it was demonstrated the concentration of $CO:CO_2$ should be a minimum of 75:25 for complete reduction. This concentration of gas was never attained in the rotary kiln, and in addition the inefficient combustion of the heating fuel resulted in lower flame temperature which in turn resulted in slower heat absorption by the charge and consequently larger fuel consumption per ton treated.

Accretions Close Kiln

Another obstacle stood in the way of success in the rotary kiln. At the point of maximum iron oxide reduction the charge always adhered to the lining and accretions gradually formed a ring of iron, slag and included coal around the inside periphery. Constant additions finally closed the passage through the kiln so that in a few days it was impossible to pass the charge through.

Subsequently, an attempt was made by United States Steel Corp. to produce iron in the rotary kiln by the Hornsey-Wills process at Lorain, Ohio. C. Harold Wills, now metallurgist with the Dodge division of Chrysler Corp., Detroit, was active in this venture with Hornsey, an interested engineer who had been to England with the process. The project was dropped some time after its inception. Likewise, the Ford Motor Co. met with difficulties in producing sponge iron in the rotary kiln by the Bourcoud process at Detroit. Similarly an attempt to make sponge iron in the rotary kiln by the Onondaga Steel Co., Syracuse, N. Y., met with failure.

It is interesting to recall that the original Hornsey-Wills experiments involved the sealing of coal and lake ore in about a 4-foot steel drum, then heating to the reduction temperature and cooling. The sintered mass then was barred out of the drum and beaten or hammered to remove nonmetallic impurities. The metal subsequently was melted in the open hearth, poured into an ingot and rolled into a rail. This rail, produced from direct reduced iron ore, persuaded executives of the Steel corporation, it is said, to appropriate funds for the experiment into direct reduction, it is related, but in later equipment the coal and ore were not sealed in a container as in the first experiment.

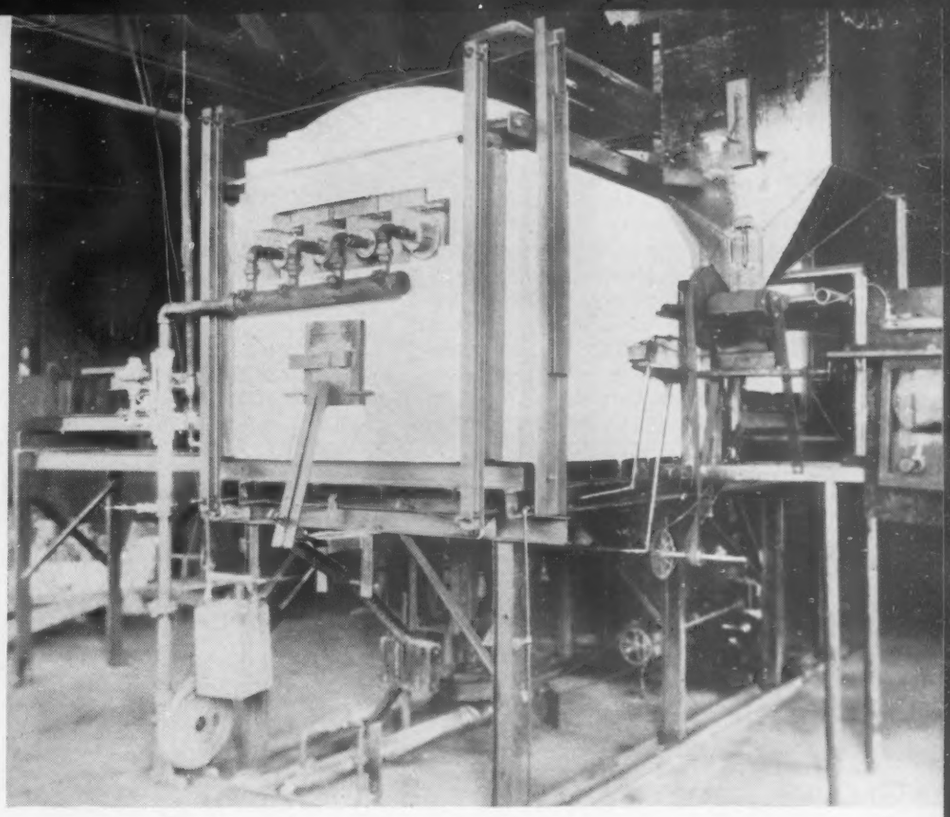
About 50,000 tons of iron, 97-98 per cent pure, were made at Lorain, according to Mr. Wills. Open-hearth heats were made with varying percentages—25, 50, 75—of sponge iron in charges. When over 50 per cent sponge was charged, ingots were found to be "dry" with cracks at corners and unsuited to further use.

Try Steel Tube Furnace

With the discovery that reducing conditions are more easily controlled in a retort or muffle, the natural next step was to examine possibilities of the cylindrical steel tube furnace (3) with transport screw. The first obstacle which confronts the investigator is the character of the material used in walls of the retort or muffle. The most effective heat conductor will be a metal, if it will withstand the oxidizing influence of the heating flame to the necessary degree.

Ordinary steel will not last much longer than a day or two. High-

Exterior of pilot plant at Muskogee, equipped with dual 8-foot diameter hearths and coal distillation furnace



Smaller muffle furnace of rotary hearth type erected at Muskogee, using natural gas as reducing agent. Capacity is 250 to 300 tons of reduced iron per day. Note hopper feed at one side; rabble arm extends across hearth and through opposite side. Four gas burners fire through silicon carbide tubes spanning the hearth. In operation the door at the front is left open to allow escape of reducing gases. Photo courtesy Quigley Co. Inc., New York

temperature alloy steel will last much longer, but it, too, will oxidize gradually under the high temperature necessary to obtain a commercial output from the retort. Economy dictates that temperatures must be high enough to produce sponge iron inside the tube in a reasonably short time—perhaps 10 to 20 minutes. These high flame temperatures necessary on the outside of the tube are severe in their destructive action.

This introduces the subject of the range of temperature necessary to produce sponge iron. Generally, iron oxide may be reduced to iron beginning at 700 degrees Cent. From 700 to 950 degrees the reduction is too slow for commercial production. Generally speaking, an iron ore with high iron content may be processed at a temperature of 1050 degrees or slightly lower. The limiting temperature is that point at which incipient welding or fusion of the charge takes place and prevents unobstructed passage of the charge through the furnace. This limiting temperature varies somewhat with different types of equipment and with different types of ores.

Production of sponge iron in a horizontal metallic tube is impracticable because of the swelling action of the reduced iron. This swelling action packs the charge tightly in the transport screw and causes the sides of the metallic tube to bulge outward, breaking the wall.

Sticking Is A Difficulty

Use of a rotary inclined metallic tube is possible but impracticable because of sticking of the sponge to the inside of the tube. Operation at 800 degrees Cent. and at a 3-hour reduction period results in practically no sticking, but it also results in such a small iron production that the capital investment per ton of output becomes prohibitive. Raising temperatures to 900 or 950 degrees lowers reduction time but develops sticking in a short time.

When the charge is dropped through a vertical metallic retort the fine iron will again weld itself to the incandescent sides of the retort and gradually bridge across and render operation impossible.

In this connection an interesting test was made to determine the speed of reduction. Iron ore, crushed to pass 200-mesh and mixed with coal, was showered through 20-foot vertical retorts in which the temperature was 1000 degrees Cent. The time of descent was about 1 second and the resultant iron was completely reduced. This demonstrates that reduction is practically instantaneous if the iron ore is ground finely, if reducing gas concentrations are properly proportioned and if the temperature within the retort is about 1000 degrees Cent.

Electric Furnace Costly

Incentive to develop electrically-heated sponge iron furnaces of the resistance type (4) was not great because in few localities is electric power available at low enough cost to permit economical operation. However, tests were made on furnaces employing metallic resistors, refractory resistors and broken carbon resistors.

Metallic resistors do not permit the furnace to be operated with enough difference in temperature between resistor and charge. Further, the action of muffle gases on metallic resistors is quite deleterious.

Refractory resistors, especially those of silicon carbide, while capable of operating at higher temperatures, are considered too fragile for use in a reducing furnace. Also, restrictions on length preclude the possibility of using them in commercial furnaces in which a hearth width of 20 feet might be specified.

Broken carbon resistors were found susceptible to "hot spots" in the troughs in which the carbon is held. These spots accelerate consumption of the resistor by deoxidation of carbon dioxide. Further the current eventually will short circuit through the silicon carbide trough and thereby decompose the latter and collapse it.

Success attending sponge iron production in muffles led to experiments with circular hearth muffle furnaces heated with fuel burned in silicon carbide tubes (5a). Information gleaned from previous tests with other reduction methods suggested the decision to spread the charge loosely upon a rotary hearth so that it could expand without constriction; to fill this rotary hearth with a bed of carbon to which the freshly reduced hot iron would not adhere; to administer frequent stirrings by means of rabbles; to keep the charge spread thinly upon the hearth, permitting quick penetration of the heat, and to apply the heat to the charge by combusting fuel in a series of silicon carbide tubes supported on silicon carbide arches extending over the hearth.

Small Unit Successful

A small demonstration furnace of this type, 3 feet in diameter was built and operated continuously for two years, producing several hundred pounds of completely reduced iron per day. Then a 12-foot furnace was designed and erected, producing several thousand tons of finely divided and completely reduced sponge iron over a period of another two years.

Ore charge in the latter furnace was magnetite ground to pass 30 mesh and analyzing 60 to 65 per cent iron. Reducing agent was a subbituminous coal containing 15 per cent ash and 40 per cent volatile, which was processed to a semicoke

containing 12 per cent volatile, in a low-temperature coal carbonization plant.

Product was a sponge iron, mixed with excess semicoke and gangue from the ore. Screen sizes of the powdered iron were practically the same as those of the original magnetite charged, demonstrating the absence of sintering or agglomeration. The furnace product was subjected to magnetic separation, resulting in a sponge iron analyzing 90 per cent iron, all metallic.

Because this iron was used for copper precipitation in the copper ore pulp, it was unnecessary to clean it further. When a purer iron is wanted, it is necessary to grind the magnetite somewhat finer and pass the product over the magnetic separator several times to eliminate the fine gangue.

Sponge iron, recleaned magnetically and briquetted without any binder, was used at this time as melting stock for a cupola furnace. Briquets were charged with scrap iron in proportions of 20 to 80 per cent briquets. If more than 80 per cent of the charge was briquets it was found the cupola would not heat the metal hot enough to obtain satisfactory castings. Sponge iron, because of its purity, has a high melting point (melting point of pure iron is 2795 degrees Fahr.), so that it is desirable to mix sufficient scrap to lower the melting point of the charge and improve fluidity.

Product Used Successfully

Thus it was possible at this mining property (Chino Copper Co.), hundreds of miles from the nearest source of pig iron, to substitute sponge iron briquets for pig in the production of plant castings, and to obtain better castings. It was also possible to produce small quantities of steel from sponge iron in a high-frequency induction furnace, it was found.

News of successful operation of muffle-type furnaces for ore reduction spread, and in a short time an engineering firm organized by Anderson was commissioned to design and build a sponge iron plant for Japanese interests, comprising two annular rotating-hearth furnaces (5b) capable of producing 50 tons each of iron per day when treating a beach sand containing 20 to 25 per cent iron of which 3 to 5 per cent was iron as ferrous oxide in ilmenite (containing titanium oxide).

The equipment was erected as a pilot plant by Japanese industrialists who owned the beach sand deposit—an ancient deposit elevated about 800 feet above present sea level, covering a large area and often diluted with waste during mining to bring iron content down as low as 20 per cent. This iron ore deposit was said to be the only source of iron on the mainland of the empire, and it is believed the Japanese government was behind the activities of industrialists seeking to make commercial use of the ore.

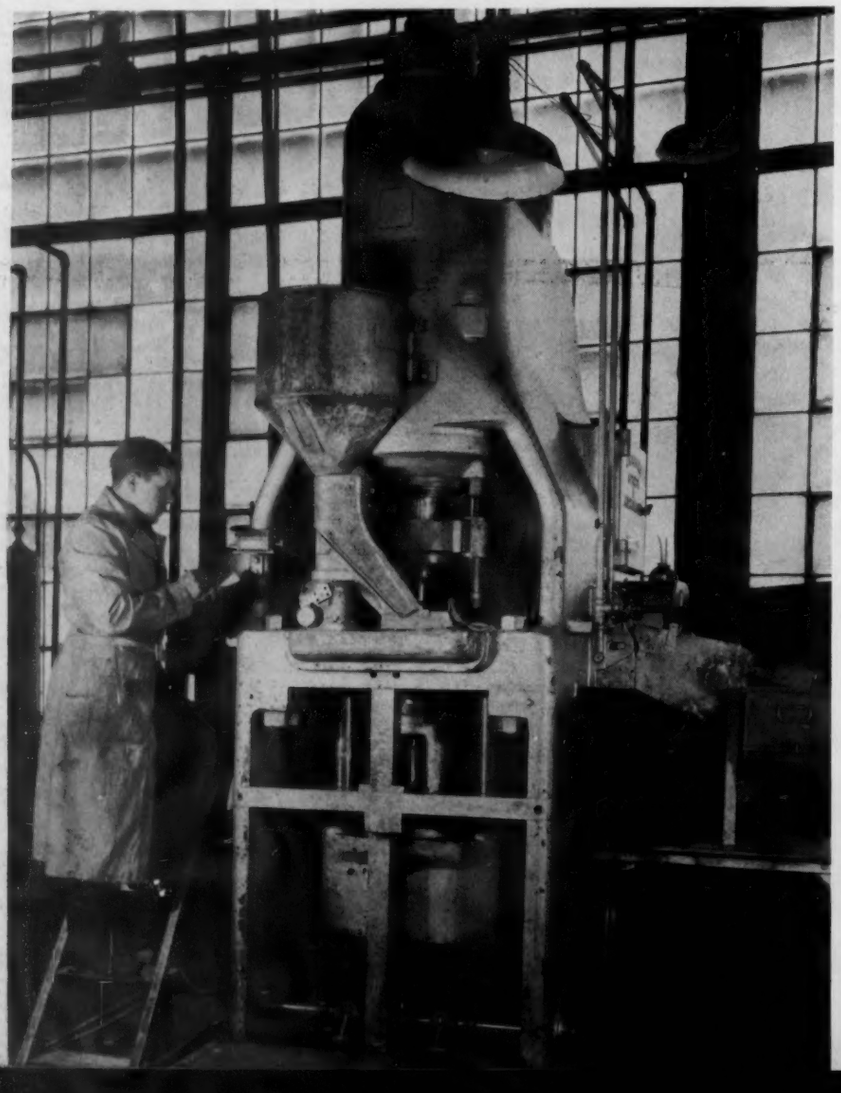
Furnaces were 60 feet in outside diameter, with annular rotating hearths 12 feet wide. Raw producer gas was distributed to burners through bustle pipes encircling the furnaces, the gas burned in 72 silicon carbide tubes per furnace, these supported on silicon carbide arches sprung over the hearths. Arranged radially, the tubes tapered from a diameter of 10 inches at the outer edge of the hearth to 6 inches at the inner edge. Spent combustion gases were discharged into an annular waste gas flue and then to a multiple-hearth McDougall preheating furnace. Heat from the fired tubes was radiated to the charge of ore, sand and semicoke on the hearth, 30 inches below the tubes. The charge, after passing through the preheating furnace gravitated to the inside periphery of the reduction furnace hearth, then being rabbled to the outside periphery by the rotation of the hearth and the action of eight stationary rabble arms set at angles of 45 degrees around the hearth.

Only 70 Per Cent Iron

Semicoke, containing 12 to 15 per cent volatile, was added on the hearth to the preheated charge for reducing the iron oxide. Resultant sponge iron, mixed with ilmenite and silica, was discharged into a steel cylinder rotating in a reservoir of water and cooled to atmospheric temperature. The product then was passed over magnetic separators, but it was impossible to obtain an end-product with more than 70 per cent iron on account of the ilmenite which had been rendered strongly magnetic during the reduction.

The magnetic product was briquetted without binder, in mechanical presses, briquets being 4 inches in diameter and 2½ inches long. They had sufficient strength to withstand six rough handlings in coastwise steamships to Kobe, Japan, where they were used in producing both open-hearth and electric furnace steel.

Although circuitous reports as late



Hydraulic-type briquetting machine for initial forming operation on powdered metal bearings and parts, specially built for the Amplex division, Chrysler Corp.

as 1936 indicated the plant to be still in operation, inadequate preliminary prospecting and development of the iron and lignite deposits resulted in considerable disparity between original estimates and actual costs, classifying the project as primarily ill-advised.

Used For Bearings

In recent years, a growing demand for sponge iron for use in the pressed-bearing or oil-less bearing industry has been evident. Both Chrysler Corp. and General Motors Corp. now operate divisions active in the pressing and sintering of sponge iron into bearings for a wide range of uses where prelubricated or permanently lubricated bearings are advantageous. Such uses are multiplying rapidly, and in addition experiments are proceeding along the lines of perfecting other applications of pressed and sintered iron powder; for example, one current project involving the fabrication of automotive brake drums in this fashion. Further, sponge iron has been found to be a valuable waterproofing ingredient in concrete aggregate for highways.

This trend led Anderson to the decision to erect a small, commercial plant in Muskogee, Okla., to be used for pilot-plant purposes in the testing, by low-temperature reduction, of iron ores, tin concentrates, tungsten concentrates, oxidized lead and zinc ores, roasted zinc concentrates with high iron content, nickel oxide, cobalt oxide, and the production of "black ash" by the reduction of heavy spar.

The plant, shown in an accompanying illustration, houses a furnace with two circular hearths (5c), each 8 feet in diameter, one a preheating hearth and the other a muffle hearth, the former 2 feet higher than the latter and separated by 2 feet. A silicon carbide muffle, built of matched tile, is sprung over the muffle hearth to keep muffle gases separate from the combustion gases during the reduction.

The charge may be added either to the preheating hearth or directly to the muffle hearth. During preheating, the charge is rabbled continuously from the center to the outside edge of the hearth, where it is scraped off by a discharge rabble blade and falls into a hopper through which a water-cooled screw conveyor transports and cools the hot material to atmospheric temperatures. The cooled material then is discharged into the air through a gas-locking device which prevents egress of furnace gases and ingress of air.

Material charged on the muffle hearth is mixed with semicoke and during reduction is rabbled continuously, being discharged into a water-cooled screw conveyor which reduces the temperature to atmospheric. A stationary rabble arm extends through the furnace and across the top of the rotary hearth. To this arm are fastened silicon carbide rabble blades which stir the material on the hearth during reduction.

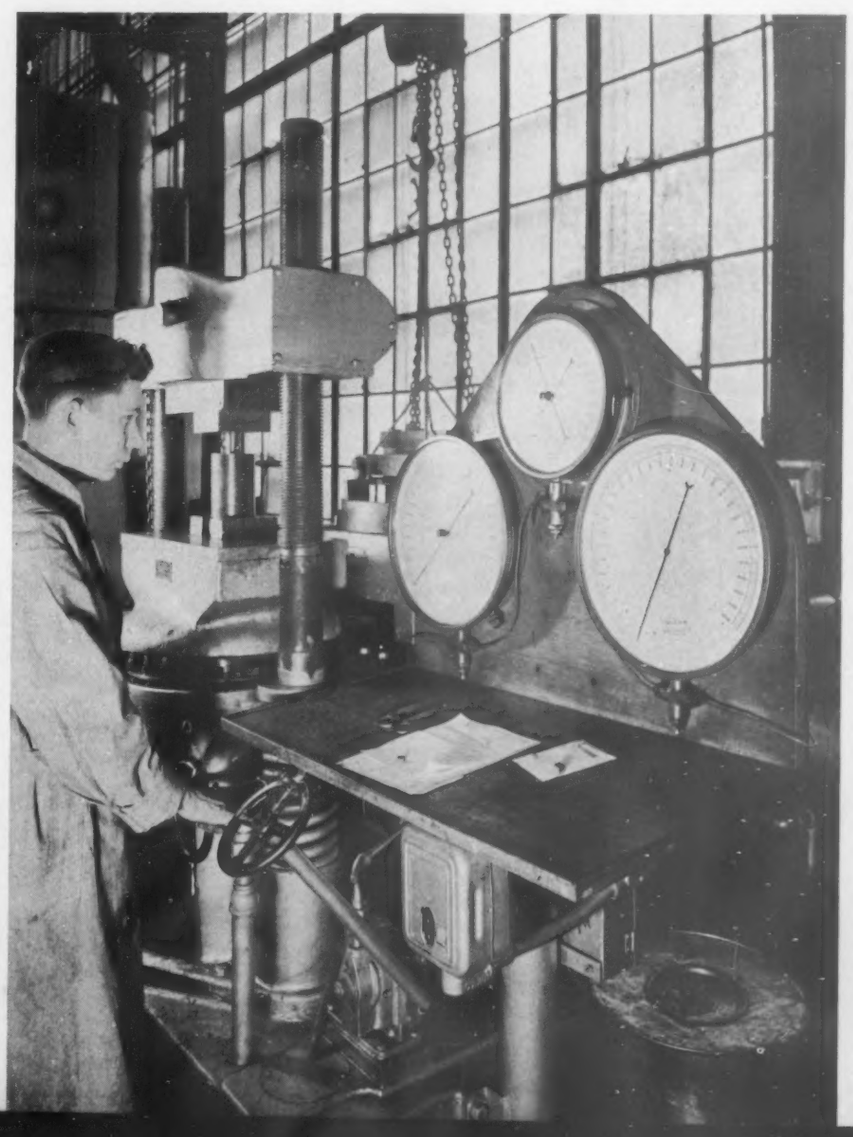
Semicoke is added to the muffle hearth only because it will burn if added to the preheating hearth, inasmuch as the latter is exposed to the open flame of the heating fuel. Heat is supplied by burning fuel oil in a combustion chamber over the top of the silicon carbide tile arch. The heat is conducted through the arch and radiated to the moving charge on the rotary hearth. The reduction action within the muffle generates carbonaceous gases which induce a gas pressure of several hundredths of an inch of water. This pressure expels the muffle gas continuously to the atmosphere through a port in the wall of the muffle and prevents ingress of air.

Reduction on the muffle hearth proceeds in from 10 to 20 minutes if the ore is ground to 35 mesh. The product, consisting of finely divided iron, excess semicoke and gangue from the iron ore, is passed over a magnetic separator to eliminate the nonmagnetic waste from the iron, leaving a sponge iron ready for use. If it is to be melted in a furnace or is to be transported in other than powdered form, it is advisable to briquet the material; otherwise it is sacked for shipment.

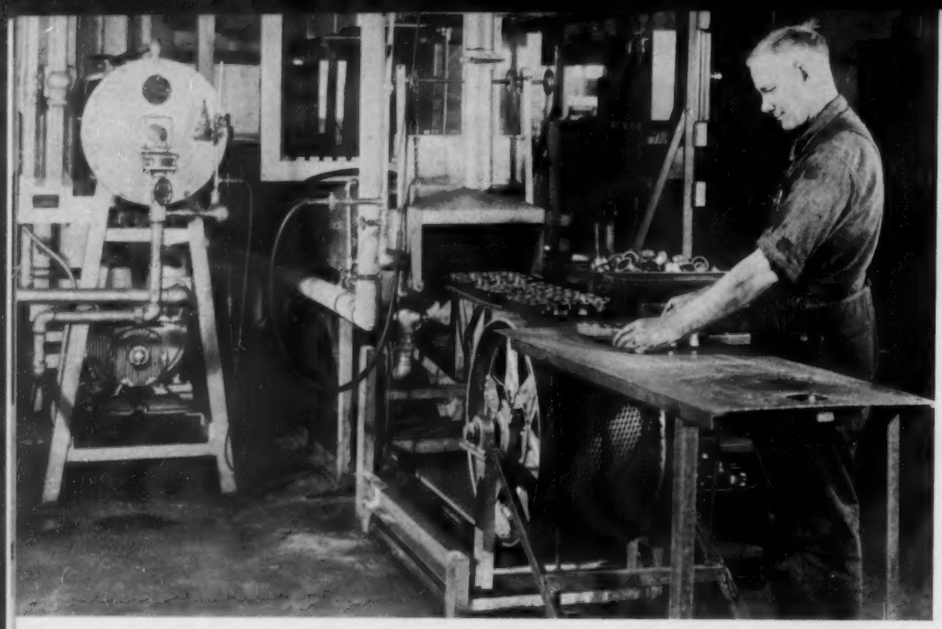
Obtains 98 Per Cent Iron

Sponge iron, reduced in this furnace from mill scale (of which there is a plentiful supply in steelmaking districts) contains from 96-98 per cent iron. Sponge iron, reduced from ores, may contain anywhere from 80 to 98 per cent iron, depending upon the degree of intimate association of the iron oxide and the gangue of the iron ore. By grinding the ore to a finer state it is often possible to liberate more gangue.

More recently, it was decided to investigate the possibilities of natural gas as both a heating fuel and reducing agent, there being an abundant supply of gas at low cost in Oklahoma. A second pilot plant was erected at Muskogee, somewhat smaller than the one just described, but similar in construction, except



Heavy-duty hydraulic powdered metal briquetting press at Amplex division, Chrysler Corp. Gages at the right provide accurate indication of pressures



Controlled atmosphere electric furnace with mesh-belt conveyor used for sintering pressed powdered metal parts at Moraine Products division, General Motors Corp., Dayton, O. This view is the discharge end of the 20-foot cooling chamber. Belt is 12 inches wide, door opening 8 inches high, heating chamber 10 feet long, rating 102 kilowatts, maximum operating temperature 2100 degrees Fahr. Combustion-type atmosphere generator is shown at left. Photo courtesy General Electric Co.

that only one rotary hearth is used. The furnace has capacity of about 250 to 300 pounds of sponge iron per 24-hour day. Hearth diameter is 43 inches with an 8-inch center hole for discharge of reduced material, tapering to 2½ inches. Four gas burners, supplied through a blower and proportional mixing valve, fire into four 52-inch silicon carbide tubes, each 5¾ inches in outside diameter and located 22 inches above the hearth. Combustion gases discharge into a small auxiliary chamber at the rear of the furnace in which it was originally proposed to crack the reducing gas, but later this was found to be unnecessary.

The hearth may be rotated at three different speeds—one revolution in 45, 75 or 155 seconds. It is completely sealed from outside air by sand seals around the outer lower edge. Outer rim of the hearth, as well as the center core are of refractory, the intermediate portion being filled with small pebbles topped with a layer of fine coke. Reducing gas is introduced into the muffle and reduces the iron oxide in the hot charge as it is rabbled toward the center discharge. A small door in the front of the furnace permits egress of the reducing gas and it burns with a slow, lazy flame while the furnace is in operation, thus sealing air from the muffle and permitting the operator to watch the reduction process and remove "stickers" from the rabble blades.

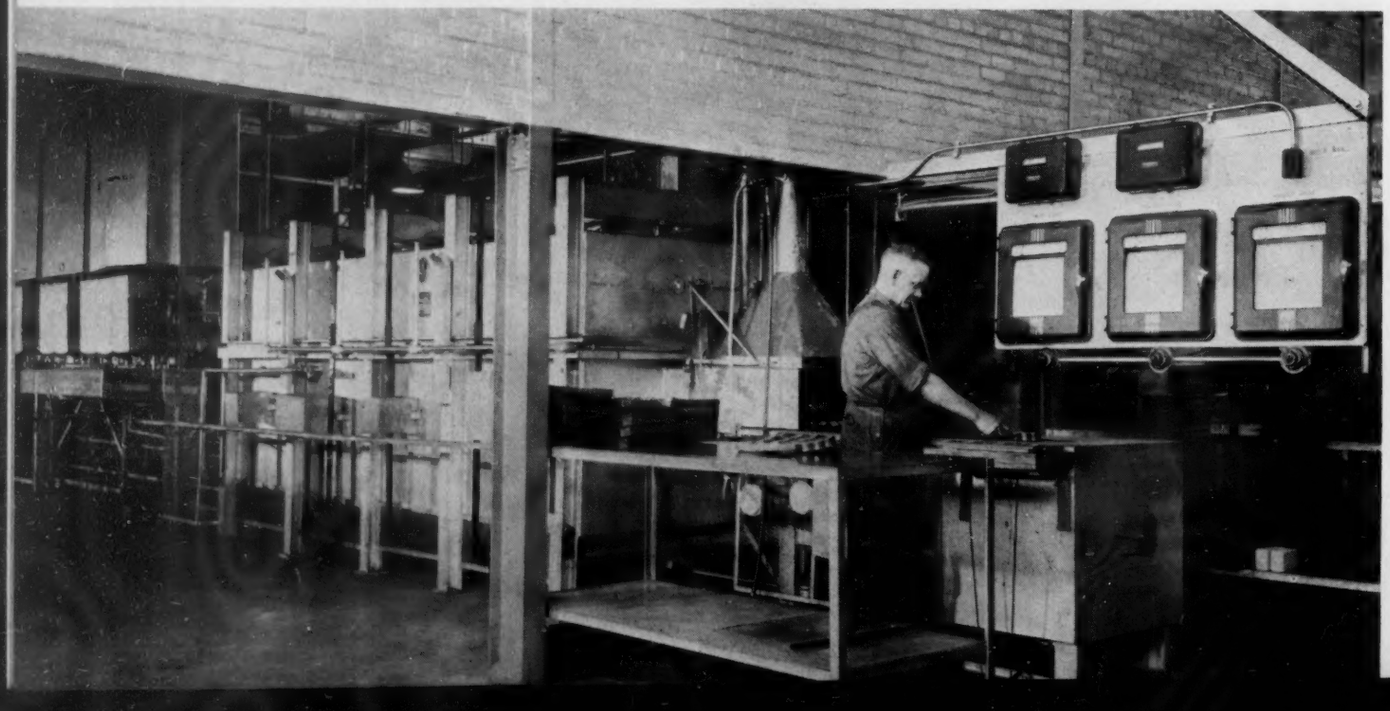
A rabble arm, of heat-resisting chrome-nickel alloy steel, extends through the sides of the furnace and across the hearth. To it are attached 15 rabble blades of silicon carbide, practically touching the hearth. The blades, eight on one side and seven on the other are set at an angle to keep the charge moving toward the center, being distinguished as cutters and pushers.

Material to be reduced is mixed with a specified quantity of semicoke (10 to 15 per cent volatile), or with metallurgical coke or coke breeze when natural gas is the reducing agent, and deposited in a hopper at the right side of the furnace. A belt feed at the base of this hopper is geared with the hearth speed and feeds the charge onto a screw which conveys it onto the furnace hearth.

In a furnace using semicoke only as a reducing agent, a weight of coke amounting to half the amount of iron produced is mixed with the charge. With natural gas used as a reducing agent, as in this latest furnace, amount of coke ranges from 5 to 15 per cent of the weight of the ore charged. The coke is added to prevent sintering of the charge.

It is to be noted that metallurgical coke, anthracite coal or graphitic carbon will not appreciably reduce iron oxides at the temperatures prevailing in low-temperature reduction. It requires what may be termed an "amorphous carbon," such as results from the low-temperature carbonization of coal, which product should contain 10 to 15 per cent volatile matter; or from nascent carbon resulting from the decomposition of natural gas; or from the use of externally produced carbonaceous

View at charging end of sintering furnace at Moraine Products division, General Motors Corp. Operator is placing briquetted parts on heat-resisting alloy trays which travel through furnace on mesh belts. Photo courtesy General Electric Co.



gases such as water gas or producer gas. Hence, coke breeze is used as a sticking preventive primarily.

Temperature in the furnace is controlled through a thermocouple and an indicating pyrometer. At the time this writer witnessed the operation, it ranged from 1930 to 1970 degrees Fahr., with a mill scale finer than 35 mesh being reduced. The hearth was being operated at intermediate speed, with reduction accomplished in about 15 minutes. Resultant sponge, by chemical analysis showed 96 per cent iron, 100 per cent reduced; in other words the remaining 4 per cent comprised carbon or coke not removed in the magnetic separator, a small amount of silica and some manganese existing in the original mill scale.

Suitable Ore Types

In a later run, an East Texas reddish brown limonite ore, analyzing 52.8 per cent iron and ground to 200 mesh, was reduced to a sponge showing 81.8 per cent total iron, 97 per cent reduced. The latter test was considered inferior by Anderson.

This leads to a consideration of what type or types of iron ores are best suited to low-temperature reduction. At the outset it should be stated that every ore is a "law unto itself" and only by dint of repeated tests can suitability for reduction be determined. Of major importance is the gangue or silica content of the ore and its intimacy of association with the iron oxide. In some ores, for example the silica is intimately associated with the iron oxide and prevents acceptable magnetic separation of the sponge iron from the silica, although the iron oxide is perfectly reduced; other ores can be made more suitable for direct reduction by a so-called "magnetic roast" preceded by a scuffing or rubbing process in tube mills. The latter process, now under test by the bureau of mines, in effect works the iron oxide off the silica gangue, leaving it free for reduction.

The magnetic roast involves mixing the ore with 3 per cent coal, heating with a bare flame at 1300 degrees Fahr. in an air-tight chamber. This treatment reduces ferric oxide to ferro-ferric or magnetic oxide which then can be extracted by magnetic separator. The iron content of an ore sometimes can be raised from, say, 50 per cent to 65 or 70 per cent by such roasting.

For a high-purity sponge such as demanded for pressed and sintered parts, the magnetite ores or mill scale are the best materials for reduction. Mill scale is first heated to remove accumulated oil, and then ground to proper size for reduction. Hematites and limonites can be processed into an 80 to 85 per cent sponge without magnetic roasting. Titaniferous ores require a higher reduction temperature and the resultant sponge is not suitable for pressing. Pyrites are ideal for reduction after they have been calcined. but sulphur cannot be brought much below 1 per cent—too high for use in steelmaking. However, a chlorodizing roast will convert pyrites into an excellent material for direct reduction. Pyrites are treated with chlorine to form iron chloride and sulphur. The former is dissolved in water to separate from silica, and then oxidized to Fe_2O_3, liberating chlorine which can be used over again.

Phosphorus Not Reduced

Phosphorus, generally present in iron ores in the form of tricalcium phosphate, is not reduced at temperatures used to reduce iron oxide; therefore no alloying or chemical combination of iron and phosphorus occurs. Sponge iron, reduced from high-phosphorus iron ores which have been ground to pass 35 mesh generally will retain about half of the tricalcium phosphate attached mechanically to the iron after magnetic separation. Finer grinding will eliminate more of this phosphate. However, if the sponge is to be used in iron or steel production, this is unnecessary because the tricalcium phosphate is eliminated by slagging during the melt.

Adhering manganese oxide also may be eliminated by slagging. Varying amounts of this oxide will cling to the sponge iron after magnetic separation since manganese oxide is only reduced to manganous oxide at the temperature of iron reduction. Likewise silica is not reduced and will cling with varying degrees of tenacity to the reduced sponge, some elimination being possible by magnetic separation.

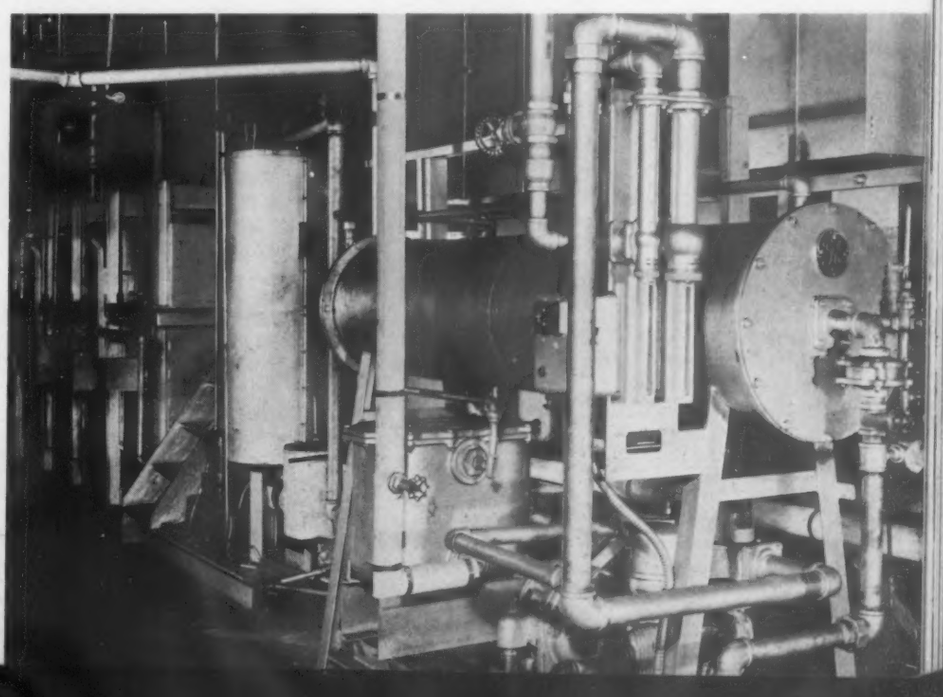
Little Combined Carbon

Carbon does not combine chemically, or at most in minute amounts, with sponge iron during the 10 to 15 minutes in which the iron and reducing agent are in contact in the furnace. A combined carbon content of 0.03 per cent is maximum for a contact of this period. If time in the furnace is increased to 30 minutes, then combined carbon is likely to increase to 0.1 per cent in the sponge. Further, a small amount of semicoke entrapped in the sponge and not removed during magnetic separation, often accompanies the iron.

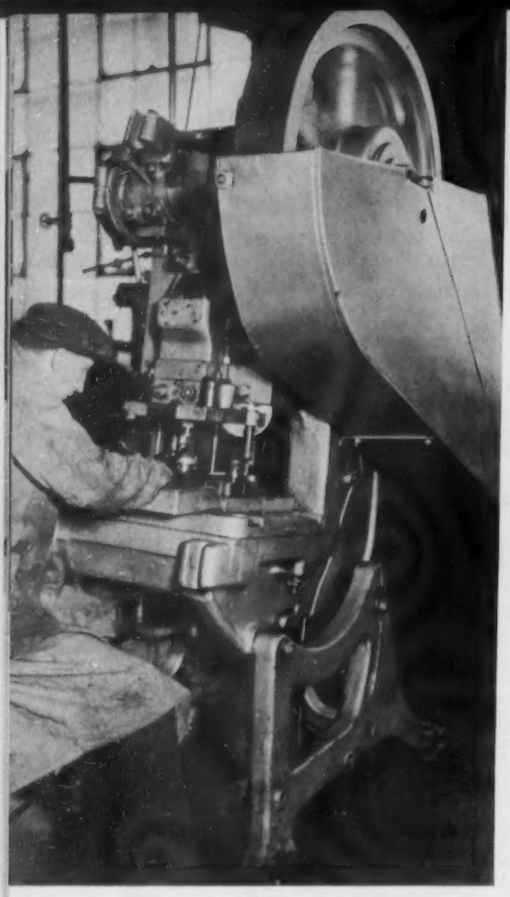
In the reduction furnace using natural gas, a carbon deposit may be precipitated by nascent carbon in the gas, especially when the furnace is first started or when operating conditions have not been adjusted properly. Some of this carbon can be removed by blowing out with a fan installed in the magnetic separator. Its presence is readily detected by virtue of its blackening effect on the sponge which, under ideal conditions, emerges from the discharge screw uniformly gray in color.

Chromium and vanadium oxides are not reduced at the temperatures used to reduce iron oxides. Chrome iron ore, however, may be charged to the sponge iron furnace with semicoke, and the ferrous oxide present is reduced to metallic iron. The resultant mechanical combination of iron and chromic oxide is magnetic and the magnetic concentrate produced contains a much higher chromic oxide content than possible by present methods of chrome iron ore concentration.

Other metals also may be reduced



Combustion - type gas generator (right) supplying 2000 cubic feet of gas per hour for sintering furnace in background. At center is refrigerated gas cooler. Photo courtesy General Electric Co.



Mechanical sizing press at Amplex division, Chrylser Corp., for restriking parts after sintering operation. On large-run orders, parts are handled through automatic dial feed. Dies are alloy steel, ground and lapped to the same accuracy as a plug and ring gage

from their metallic oxides in the sponge iron furnace. Anderson has produced successfully the following: Nickel, cobalt, ferrotungsten powder, tungsten, tin, lead, zinc, and copper. Nickel and cobalt are reduced from their ores in exactly the same way as sponge iron is made, with the same equipment. Wolframite concentrate mixed with semicoke may be reduced to a mechanically inseparable combination of sponge iron and sponge tungsten together with whatever manganese oxide occurs with the wolframite. Ferberite concentrate produces a ferrotungsten powder containing less manganese oxide. These ferrotungstens are comparatively free from carbon, it has been found.

Tungsten powder may be reduced from tungstic oxide at 1050 degrees Cent., but the product, if reduced with semicoke, must be separated by oil flotation or gravity concentration; if reduced with gas, the resultant tungsten powder requires no subsequent treatment. Powdered tungsten, reduced by semicoke, is not so pure as that produced by reduction with gas.

Tin oxide is completely reduced in from 10 to 15 minutes at 980 degrees Cent. if the tin concentrate is crushed to pass 35 mesh. Molten tin seeps through the semicoke bed on the hearth and drains to a kettle suspended below the rotary hearth. A low-iron tin concentrate is advisable since selective reduction between tin oxide and iron oxide at this temperature is not possible.

Oxidized lead zinc ores may be reduced selectively, particles of lead coalescing on the hearth and the zinc reduced as vapor and collected either by condensing or burning to zinc oxide.

Speed of Iron Reduction

A vital factor in the cost of sponge iron is the speed of its reduction. In general, Anderson's tests have shown the commercial feasibility of producing 50 to 75 pounds of metallic iron per square foot of hearth area per 24 hours, assuming the charge to be cold, crushed to 30 mesh and comprising either the 50 per cent grade of iron ore or mill scale. This figure also contemplates no preheating of combustion air. If the ore or mill scale is preheated to about 1800 degrees Fahr. before introducing to the reduction hearth, capacity is increased approximately 70 per cent per square foot of hearth area per day.

Degree of Iron Reduction

If the ratio of concentration of CO to CO_2 is 75 to 25 per cent or greater; if the time of reduction and the temperature bear their proper relationship; if there is no leakage of air into the muffle, and if the sponge iron is cooled to atmospheric temperature before it is discharged into the air, then the reduction will be substantially complete—99 per cent or more. It has been noted on numerous occasions that an opening the size of a lead pencil in the sand-seal on the discharge pipe below the furnace hearth will cause reduction to drop from 100 to 90 per cent. Further, if the quantity of water in the water-jacketed discharge mechanism is insufficient to cool the iron to atmospheric temperature then iron particles will show plainly a bluish tinge upon exposure to the air, indicating a slight degree of re-oxidation.

Cost a Prime Issue

In any discussion of sponge iron and its eventual possibilities, the matter of cost is of vital importance. Under present conditions of limited consumption, users of high-purity sponge iron are importing material from Sweden and paying approximately $150 per ton for it. This high-grade sponge is produced by crushing and grinding only the bottom "cakes" reduced in the fireclay crucibles referred to earlier in this article. Upper cakes reduced in these crucibles range from 88 to 94 per cent iron and are reported to be available for $45 to $50 per ton in solid form.

It seems apparent that a potential market for sponge iron many times the size of that existing today is awaiting only the production of a high-purity domestic sponge iron which can be sold for around $40 per ton. In other words, prospective users are waiting for the "price to create the market." Conversely, those active in the development of sponge iron production methods state flatly that the "market must create the price"—in other words, if a guaranteed outlet for a sufficient quantity of sponge was available, then and only then will it be prudent to set up plant and equipment for supplying the iron at the wished-for price. And it is reliably stated that a plant can be built to supply a daily requirement of 50 tons of sponge iron and show a profit at a price of $50 per ton. A larger plant might lower costs still further.

Demand Must Increase

The latter course would appear to this writer to be the logical one. It is utter folly to erect a plant to glut the market with $50-a-ton sponge iron with no assurance users can accommodate the output which such a plant would have. As in nearly all new developments, price must be determined by volume of output, and as the latter increases, the former decreases.

It might be inferred that erection of a modern sponge iron plant would be an ideal project for idle capital, but idle capital is loath to turn in the direction where profits are nebulous, and until users' requirements can be determined more accurately the possibilities of profit in such a venture are vague. As a matter of fact, the Fisher interests at one time invested considerable money in a plant for sponge iron production in Detroit, but the project faltered, principally because a sufficient market for the material was not developed, and also because of operating difficulties, as previously outlined. In fact, it was this plant with which the late William H. Smith was connected, and it is believed the Ford interests had invested a considerable sum of money in the venture prior to the building of this plant.

At the moment, possibilities appear bright for powdered iron. Informed sources state a market for several hundred tons daily hinges only on the matter of price of the raw material. Take the case of brake drums. A brake drum of compressed and sintered iron weighs about 10 pounds. With four to the car, a unit consumption of 40 pounds per car is indicated. Chevrolet production, for example, approximates 1,000,000 vehicles yearly; thus brake drum requirements would call for

20,000 tons of iron a year, or about 100 tons daily.

If Anderson can supply a 96 per cent iron or better, at a cost of 2 to 4 cents per pound, or $40 to $80 per ton, opinion around Detroit is he should have no trouble in lining up enough business to require anywhere from 200 to 500 tons per day, and he could even obtain long-time contracts for such a supply.

Large Volume Possible

At any rate, developments in this field bear watching. The volume production of compressed and sintered iron parts for automobile use seems to rest only on a meeting of minds of prospective users and suppliers of the powder.

An attempt to enumerate and classify possible uses for sponge iron necessarily must be sketchy and incomplete; but from present information, the following listing suggests itself:

1. Open-hearth charges.
2. Cupola charges.
3. Wrought iron production.
4. Electric furnace charges.
5. Waterproofing ingredient in concrete aggregates.
6. Iron carbonyl production for gasoline industry.
7. Copper precipitation and desulphurization of lead-zinc sulphides in mining industry.
8. Production of compressed and sintered parts.

Mention already has been made of the use of powdered iron in open-hearth and cupola charges, and the possibilities on this score do not appear any too distinct. In competition with pig iron and scrap, powdered iron necessarily must lose out on a price basis, except perhaps in isolated localities.

Some merits appear in the use of powdered iron for production of wrought iron (3), by mixing the sponge iron with powdered iron silicate slag, heating to a welding temperature to consolidate the powdered iron, squeezing to eliminate excess slag and rolling in the customary way. Wrought iron made in this way is said to have all the usual qualities of the best hand-puddled wrought iron, and as the product sells at a relatively higher price than steel and cast iron, its commercial production in the above way may offer opportunities.

In the production of alloy steel of high grade, the purity of sponge iron makes it an ideal base or sweetener for electric and crucible furnace charges (4). Already it has been put to some use in the production of tool steel, cutlery, saw steels and steel for valve spring wire. Here again the higher price of the product makes feasible the use of higher cost ingredients.

Powdered sponge iron as a waterproofing ingredient in concrete aggregate (5) is another special outlet. It is expected a considerable demand eventually may develop for use of this iron in concrete highway construction in climates subject to alternate freezing and thawing and therefore to cracking and spalling. Iron powdered by grinding turnings in a ball mill is now used in a small way for waterproofing purposes, but is too costly to be used as an ingredient in concrete aggregate and cannot hope to compete with sponge iron for this purpose.

Makes Antiknock Gasoline

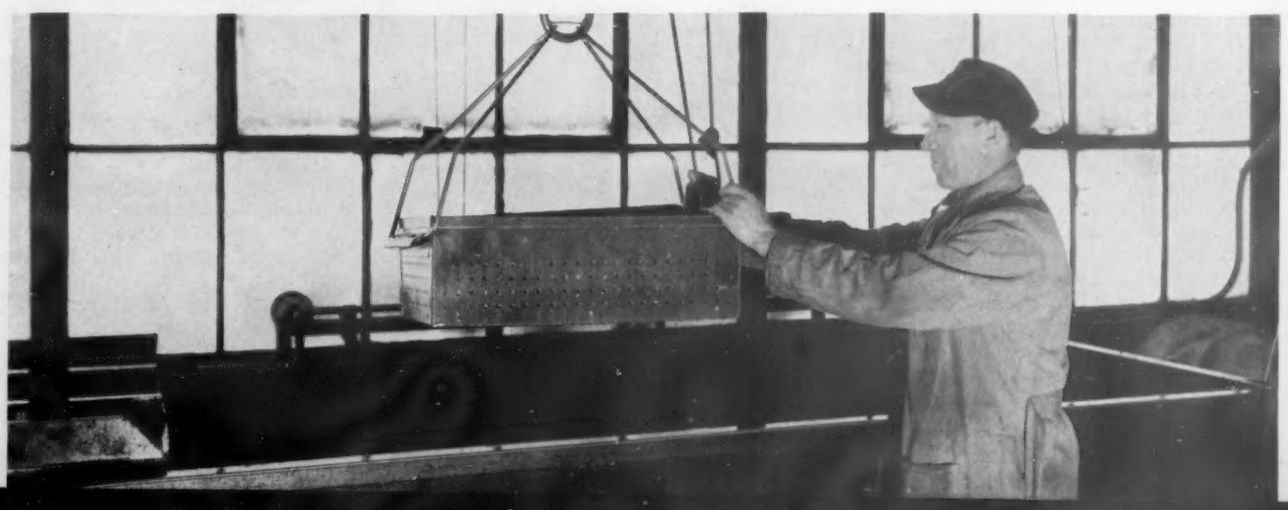
Experiments have been made in the application of iron powder for preparation of iron carbonyl, $Fe(CO)_5$, which has been demonstrated to be a suitable fluid for imparting antiknock properties to gasoline. The carbonyl is produced by passing pure carbon monoxide over powdered iron at 350 degrees Fahr., forming a mist which is condensed. It weighs about 12 pounds to the gallon and has been marketed for around $8 per gallon. Iron carbonyl also has been used to some extent in the removal of sulphur from oil and gas. From a tonnage standpoint, the requirements for sponge iron would appear limited[1].

Already mentioned has been the use of sponge iron for copper precipitation, an outlet which has shrunk since copper ores have become mostly of the sulphide type rather than oxide. Production of sponge iron for the desulphurization of mixed lead-zinc sulphides (7), obtained as a "bulk" flotation concentrate from complex lead-zinc ores, has been reported. Metallic lead and metallic zinc may be produced directly from the concentrate by treatment in a special design of high-frequency induction furnace, a process which necessitates low-cost electric power since it requires about 2000 kilowatt-hours per ton of zinc and 300 kilowatt-hours per ton of lead produced. Metallic antimony may be produced by direct desulphurization by powdered iron in a similar way.

As intimated previously, by far the greatest potentialities for sponge iron loom in the field of compressed and sintered parts (8), an outlet of which obviously only the surface has been scratched.

Those active in the manufacture of parts in this way are extremely reticent to divulge any complete details of the process, but a few essentials have been learned. In the first place, a sponge iron of 96 per cent purity or better is required. Users would like to have a 99.9 per cent material, but in most cases must be satisfied with something below this figure. The material usually must be of a size to pass 250 mesh. First step is to introduce the powder through a hopper into the dies of a briquetting press where the shape of the part is formed under a pressure of about 40,000 pounds per square inch. Allowance for subsequent sizing is about 3 per cent. Dies in the briquetting press are of special alloy steel, hardened, ground and lapped, and will withstand about 25,000 impressions be-

[1]Later communication from Anderson states that he has been investigating more thoroughly the production of pure iron powders from sponge iron, and the production and decomposition of iron carbonyl. He has found by test that sponge iron produced in his rotary hearth furnace will be dissolved entirely as iron carbonyl [$Fe + 5\ CO \longrightarrow Fe(CO)_5$] and thereafter will be broken down easily to carbon monoxide and pure iron—99.8 per cent Fe. He notes further that "it is now a question of costs, although it appears that, eventually upon a large scale, this kind of iron can be made relatively inexpensively."



Briquetted, sintered and sized bearings are impregnated at Amplex plant by dipping them for about 15 minutes in a bath of oil heated to between 225 and 250 degrees Fahr.

Physical Tests of Compressed, Sintered and Sized Bars Made from Three Different Types of Sponge Iron

Bar No.	Weight, grams	Thickness, inches: Slack (est.)	Thickness, inches: After cold press	Thickness, inches: After hot press	Size of reduced section, inches	Rockwell B hardness	Olsen load, pounds	Tensile strength pounds per square inch	Elongation, per cent	Reduction of area, per cent
					DOMESTIC IRON A					
1	50 (0.5 Cu)	0.532	0.174	0.111	0.110 x 0.365	..	.....	.....	..	....
2	50 (0.5 C)	0.532	0.172	0.116	0.110 x 0.365	72	998	23,950	2	1.7
3-4-5	50	0.532	0.171	0.108	.....	..	1,048	43,550	2	3.8
6	25	0.266	0.083	0.061	(Bend test)					
7	15	0.159	0.052	0.040	(Bend test, no ductility)					
8	88	0.946	0.295	0.186	0.175 x 0.365	..	2,331	36,400	3	14.2
9	88 (1.0 Cu)	0.946	0.295	0.183	0.175 x 0.365	..	2,226	34,000	3	14.2
					SWEDISH IRON					
1	50 (0.5 Cu)	0.266	0.150	0.104	0.110 x 0.365	82	2,405	63,600	10	10.5
2	50 (0.5C)	0.266	0.157	0.078	(Broken in handling before sintering)					
3-4-5	50	0.266	0.148	0.105	0.110 x 0.365	..	1,750	68,300	12	10.5
6	25	0.133	0.075	0.060	0.047 x 0.615		(Young's modulus 24,393,000)			
7	15	0.078	0.047	0.036	(Bend test, fair ductility)					
8	88	0.465	0.263	0.166	0.175 x 0.365	60	2,961	48,200	9	13.7
9	88 (1.0 Cu)	0.463	0.267	0.178	0.175 x 0.365	82	3,978	62 600	8	9.6
					DOMESTIC IRON B					
1	50	.....	0.157	0.097	0.110 x 0.365	..	1,712	65,300	11	14.7
2	25	.....	0.083	0.055	0.047 x 0.615		(Young's modulus 24,029,001)			
3	15	.....	0.047	0.033	(Bend test, fair)					

fore requiring regrinding for a larger size.

From the briquetting press the parts are transferred to a sintering furnace where they are subjected to a temperature in the range 1850-2050 degrees Fahr. Exact temperature is dependent upon the type of part and the briquetting pressure. High pressures mean lower temperatures, and vice versa. The maximum sintering temperature usable is about 2050 degrees, since above this point, distortion is apt to be encountered. Time in the furnace is not excessive, 15 minutes being average—10 minutes for bringing to temperature, and 5 minutes holding at temperature.

Needs Reducing Atmosphere

A reducing atmosphere must be maintained in the furnace to avoid oxidation. Both gas-fired and electric furnaces have been designed for the work, the electric units being practically duplicates of those used for copper brazing operations. Parts usually are handled on heat-resisting alloy trays, although a wire mesh belt can be used if the parts are not overly heavy and the furnace length does not exceed about 8 feet. Using an electric furnace 22 feet in length, with a roller hearth, net production is 2500 pounds per hour.

In the cooling and restriking or sizing of sintered iron parts there are two schools of thought prevalent; one believing that restriking should be done while the parts are fairly hot, in order to reduce pressures required, the other preferring to cool the pieces in the furnace to below 1000 degrees Fahr. and then to transfer them to the sizing press. If oxidation is objectionable and tolerances are small, the latter technique is preferable. Pressures in the sizing operations approximate one-third of those used in briquetting—one plant using straight-sided punch presses for restriking to size.

The sizing operation, in reality, appears to be the secret of obtaining a good part, with satisfactory strength and other physical properties. For example, after briquetting, the sponge iron will show a specific gravity of about 5; restriking hot increases this to approximately 7.

After sizing, the parts may be ground to length if required, or in some cases completely surface ground. For bearings and bushings, however, inside and outside diameters are held to tolerance in the sizing operation. Thereupon, the parts are dumped into a tank of oil where they become completely impregnated with lubricant which can be wiped off the outer surface before shipment.

Data are meager on the structural strength of this material, but from one source it is learned that compressed and sintered bushings and bearings of iron powder have been produced to withstand a bearing load of 50,000 pounds per square inch under zero velocity. This figure compares with several hundred pounds per square inch exhibited by conventional types of nonferrous bearings and bushings.

An accompanying table gives the results of physical tests on compressed, sintered and sized bars of three different types of sponge iron. Tensile strengths ranging from 23,950 to 68,300, elongations from 2 to 12 per cent and Olsen loads from 998 to 3978 pounds will be noted. These tests should not be considered typical of commercial practice, since they were made on parts produced experimentally and exhibit a wide range of values. But they do give an indication of what can be accomplished with pieces made of this material.

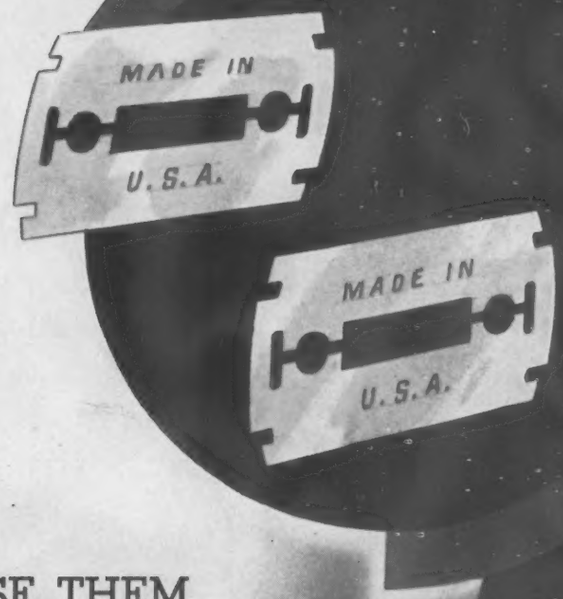
Conclusion

In concluding this extensive review of the production, processing and use of powdered sponge iron, it might be pointed out that patent literature abounds with schemes for production of iron by low-temperature reduction, most of them the brain children of enthusiasts who, in flights of fancy, see their process putting the blast furnace out of business and enriching the patentee by untold millions. At this point the first obstacle intervenes—lack of a plant to demonstrate the process. Thereafter, whatever sponge iron is produced is made either in an assay crucible or merely by conversation.

There is nothing inherently new in low-temperature reduction; but the attempt to clothe an ancient inheritance in modern dress has captivated the attention of many, all of whom—in the United States, at least—as yet have failed to make any perceptible dent in commercial acceptance of their material.

But the development is by no means dead, or even dying. Many metallurgists see in the production of sponge iron by low-temperature reduction on a commercial scale the next great step forward in their science. Certainly the foundations are being placed for a vast new industry. How fast it matures, and to what extent, are secrets shrouded in the mantle of the future.

They Look alike



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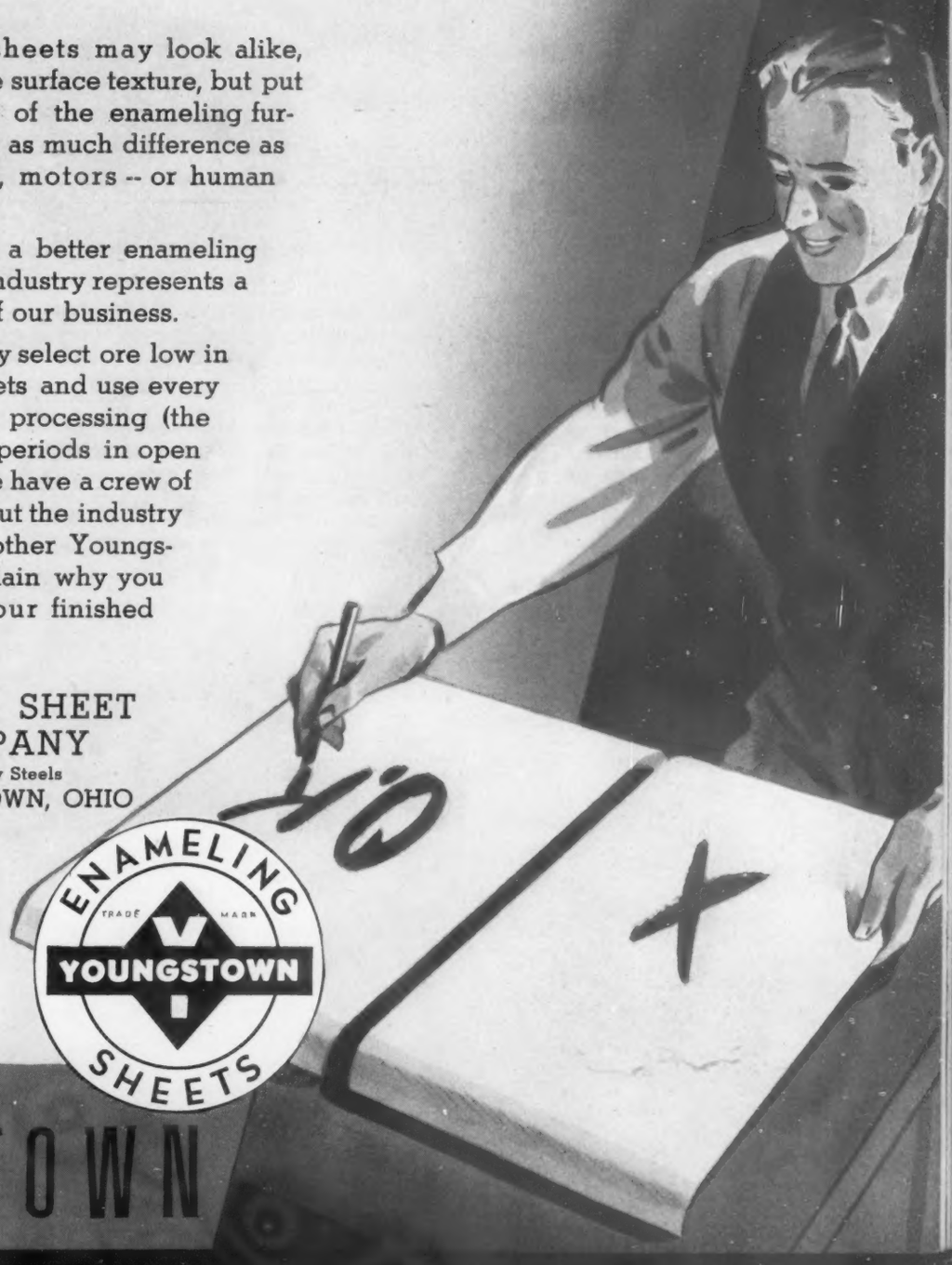

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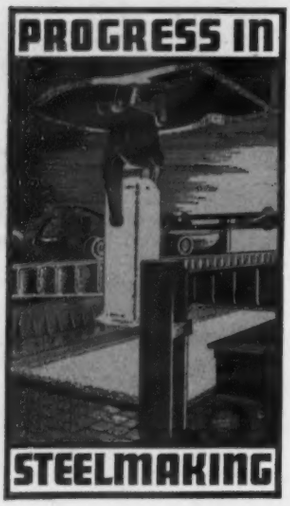


84-Inch Cold Mill

Finishing department of new mill includes 80-inch continuous pickler handling strip at 240 feet per minute. A reversing mill, 5-stand tandem mill and a 3-stand tandem mill are available, latter unit delivers 77-inch strip at 912 feet per minute

■ IN ADDITION to the 80-inch, continuous, hot-strip mill and the cold reduced, tin-plate mill at Carnegie-Illinois Steel Corp.'s new Irvin works near Pittsburgh, complete facilities have been installed for cold reduction and finishing of strip and sheet ¼-inch thick and lighter, up to 77 inches in width, in coils up to 54 inches outside diameter and 20 inches center, or in sheets up to 32 feet in length.

Hot-rolled coils for cold reduction are taken by a 20-ton crane or by ram type tractors from the coil storage room to the entry end of an 80-inch continuous pickling line. This line handles strip from 28 to 77 inches in width and has an estimated capacity of 230,000 gross tons per year. At the uncoiler, strip is bent sharply over a small diameter roller as it leaves the coil to prepare the surface for rapid clean pickling and to eliminate the possibility of coil breaks occurring. It feeds forward through an upcut shear to an electric seam welder, or if desired to a stitcher where coil ends are joined for continuous pickling.

STEEL has carried other technical descriptions of the Irvin works as follows: Continuous 80-inch hot mill, Jan. 16, p 56; coil conveyors, Feb. 13, p 69; piping, Feb. 27, p 36; truck-battery charging setup, Jan. 30, p 62

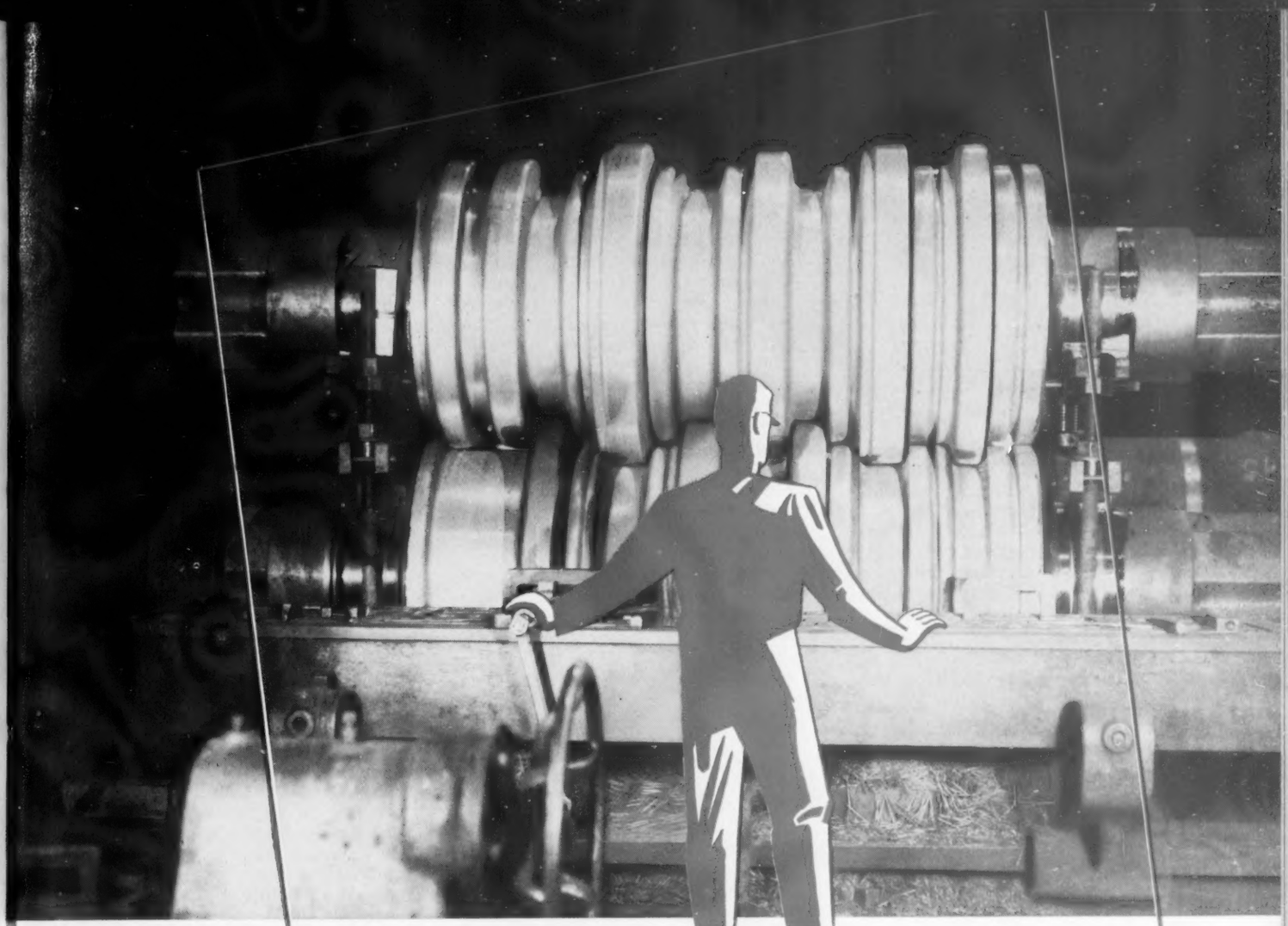
Pinch rolls take strip through the wash pit at 240 feet per minute; then strip passes through four rubber-lined, brick-faced acid tanks, a cold and hot rinse and out to the dryer. Looper pits at both ends of the pickling line permit continuous strip movement through tanks while welds or stitches are being made or cut out. An upcut shear at exit end removes welds or stitches. Coils move on across a scale to a trough type gravity roll conveyor which takes them to storage. From conveyor discharge table they are moved to storage or to the cold reduction mills by tractor.

All metal parts in the pickling line exposed to acid or fumes are protected and connected with an exhaust system to avoid steam or fumes. Rubber tank lining is protected against abrasion by acid-resisting brick. Indicating and recording instruments keep track of temperatures and strip speeds, and a constant watch is maintained over strength of acid solutions.

In the cold-reduction department, three cold mills are available. The 5-stand tandem, 4 high, 20½ and 53 x 42-inch mill is used primarily for cold reducing strip for tin plate. Other material may be cold reduced in either a 20½ and 53 x 54-inch reversing mill or a 3-stand tandem, 4 high, 20½ and 56 x 84-inch mill. All will handle the new high-tensile steels such as USS Cor-Ten, Man-Ten and stainless steel. This equipment is heavily powered and well fitted for high speed, heavy duty operation.

Reversing mill reduces 0.120-inch strip to 0.030-inch, or 0.065-inch material to 0.010-inch in three passes. The reels at each end of this mill will handle coils of 30 inches inside diameter and up to 54 inches outside diameter, taking the strip through roller levelers. Each reel is driven by a 1750 horsepower, 300

This is a general view of the 54-inch reversing mill in the cold mill department of the new Irwin works



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The new Mackintosh-Hemphill Hytensite Rolls are high test alloy cast iron, specially treated to give them extra high tensile strength. Made by the Techni process.

They contain appreciable proportions of visible graphite uniformly and finely distributed through the rolls. They have uniformity of structure and wearing and finishing qualities.

Hytensite has no "notch effect,"—so small radii on the neck fillets and various passes do not weaken the rolls. They are used in the intermediate stands of light duty blooming and roughing mills, structural and merchant mills, and in the roughing stands of sheet, bar and billet mills, replacing the "high carbon alloy" rolls of the trade.

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to 600-volt motor, operating at 525 revolutions per minute. The mill is driven by a 3500 horsepower, 600 volt, direct-current motor operating at 150 to 300 revolutions per minute, strip speeds ranging from 500 to 1107 feet per minute.

Wide strip is cold reduced in the 3-stand tandem, 4 high, 20⅛ and 56 x 84-inch mill. No. 1 stand is driven by a 2500 horsepower, 600 volt, direct-current motor operating at 225 to 450 revolutions per minute. Delivery speeds from this stand may vary from 276 to 553 feet per minute. The No. 2 stand is driven by a 3500-horsepower motor, 150 to 300 revolutions per minute. Strip speed varies from 338 to 676 feet per minute. No. 3 stand has a 2500-horsepower motor operating at 225 to 450 revolutions per minute and delivers strip at speeds between 456 and 912 feet per minute.

Use Flying Micrometers

Cold-reduced coils have an inside diameter of 30 inches and a maximum outside diameter of 54 inches. Flying micrometers maintain a constant, accurate check on strip thickness, and pressure gages are built into the mill stands so the operators may analyze rolling conditions readily.

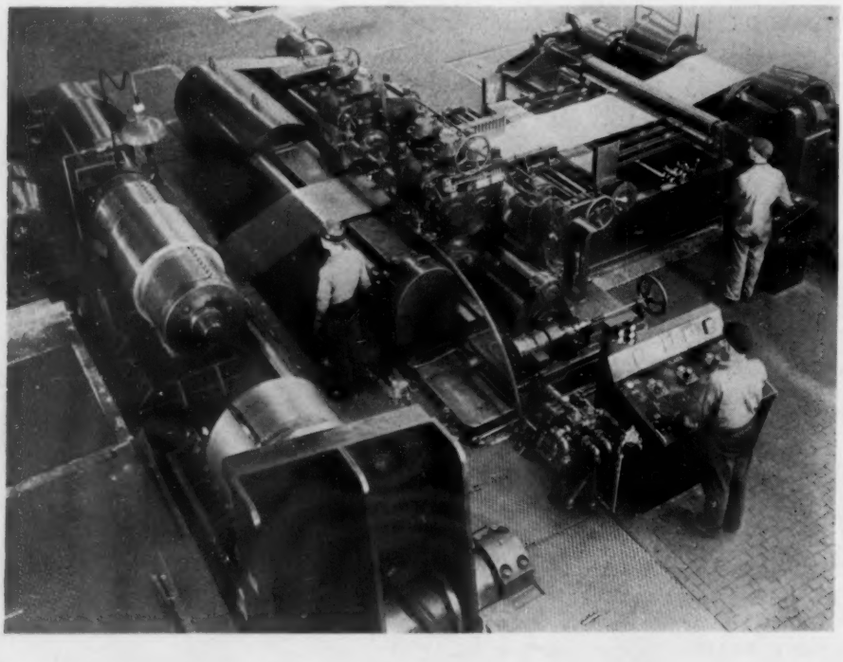
Work rolls on both the reversing and 3-stand tandem cold mills are equipped with grease lubricated, tapered roller bearings. Backup-roll necks have tapered necks, removable sleeves, oil flood-lubricated bearings thrust being taken by an integral flange on the sleeve against two stationary shoes in the chocks. Backup rolls are hydraulically balanced, roll changes being effected with a C-hook. Work rolls are changed by means of a counter-weighted rig. Provision is made to furnish both roll and strip coolants. Flying micrometers keep accurate check on the thickness of the strip being reduced. Separate circulating-oil systems are installed for each of the cold-reduction mills as well as for the temper-pass mills.

Power for the 54-inch reversing mill is furnished by two, 4000 kilowatt, motor-generator sets. A 7000 kilowatt, motor-generator set supplies the power required by the 3-stand tandem, 20½ and 56 x 84-inch cold reduction mill. This equipment, together with a 5000 kilowatt, motor-generator set for the 5-stand cold mill used for strip for the tin mill, is installed in a special room adjacent to the cold-reduction department.

These motor-generator sets are 6600-volt alternating-current to 600-volt direct-current units with a 95 per cent power factor. Down-draft circulation provided at the motor-generator sets discharges air into a nonrecirculating cooling system of 225,000 cubic feet per minute capacity. Cooled air then passes up through mill motors into the mill.

Controls co-ordinate individual drives, afford multiple speeds and emergency stops, and show roll-pressure balance, motor loads, strip speed, bus and booster voltages, entry and delivery gage or tension of strip.

Special provision is made for roll and bearing maintenance and storage. A 60-ton crane with a 15-ton auxiliary covers the roll shop and a 10-ton crane is installed over the machine shop. Both have 60-foot spans. A transfer line runs to the 5-stand cold mill and another connects with the 3-stand mill for moving complete roll assemblies easily.



Recoiler unit in cold mill department

Then after leaving the rolling mills, cold-reduced strip may either be slit and recoiled in a line capable of handling strip from 18 to 77 inches wide, 16 gage or lighter, at speeds between 150 and 450 feet per minute, or pass any of three shearing lines. These shear lines will handle strip from 18 to 77 inches wide, 11 gage or lighter, at strip speeds ranging from 150 to 450 feet per minute. Drum type shears, which may be set to cut in increments of ⅛ of an inch, cut the strip into sheets ranging from 30 to 180 inches in length. Uncoiler at each of these lines is equipped with a feeding motor. Side-trimming shears have reciprocating type scrap cutters to increase blade life and to avoid delays in the lines.

Coils are annealed in two furnaces, each with three sets of permanent bases and welded sheet steel hoods or inner covers to provide for controlled-atmosphere annealing. Eight coils, 54 inches outside diameter and 77 inches wide, may be annealed at a time.

Pack Furnaces

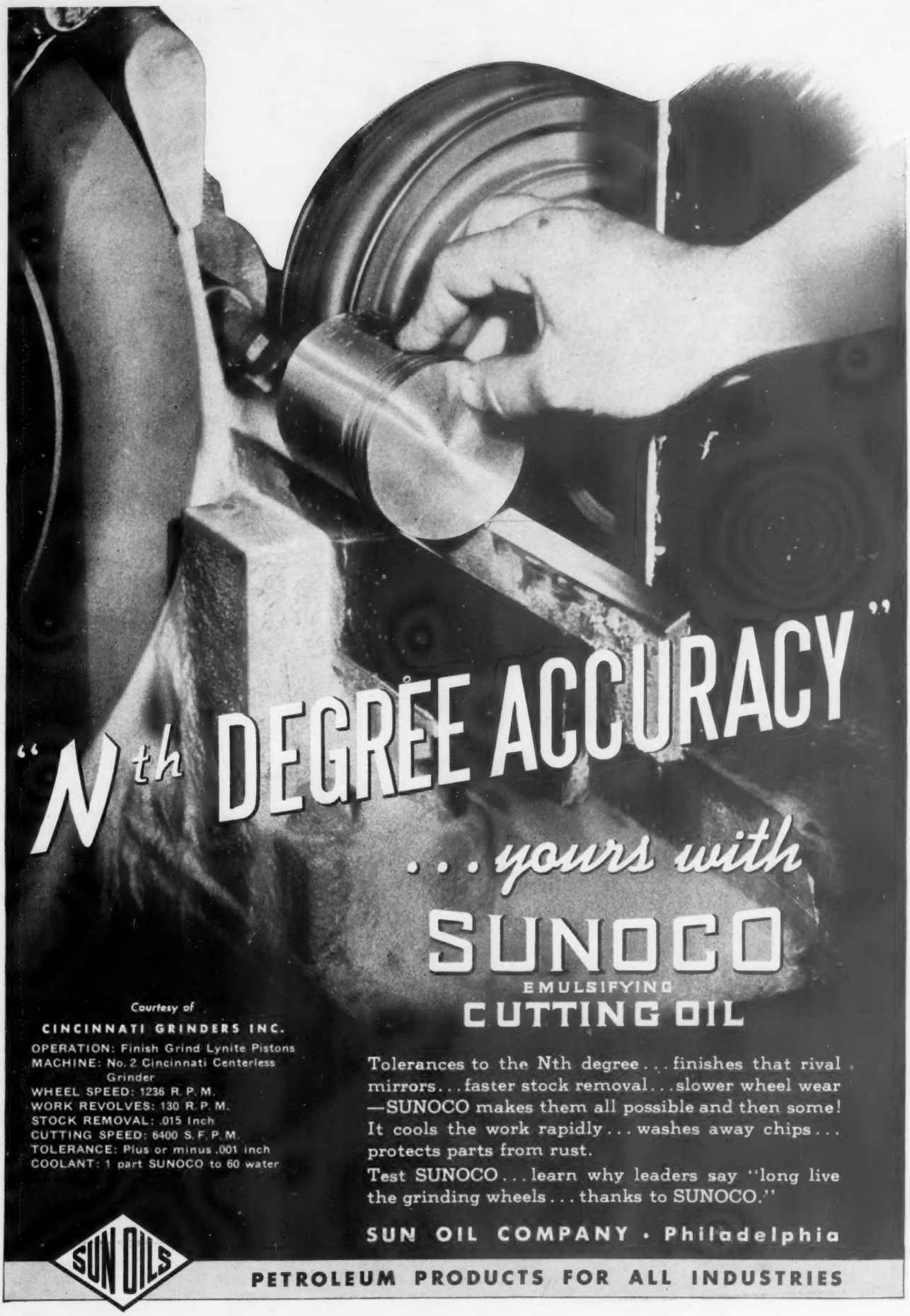
Cut sheet is annealed in two other groups of furnaces specially designed for handling packs. Each group consists of 16 heating covers and 56 permanent bases, 96 x 240 inches, with inner hoods for controlled-atmosphere annealing. Two 40-ton cranes with 15-ton auxiliaries, 120-fot span, cover the sheet-annealing department.

Sixteen of the annealing furnace heating covers have horizontal, U-shaped, tubular heating elements, using premixed gas from three centrally located gas mixing stations at 32-ounce pressure. Tests show gases from furnace vents are not toxic. The high velocity, soft flame in the large diameter tubes establishes its own gas recirculating system. No exhaust fans are necessary.

Floating temperature control is provided. At beginning of the cycle, control is maintained by a side-wall couple. When the desired wall temperature has been reached, control is switched to a top couple in the pack, a limit control being maintained through a wall couple to avoid overheating. Other couples in the pack permit check on uniformity of heating.

The other 16 annealing furnaces, used for either sheet or coiled strip, have vertical heating elements. A spark plug in each tube eliminates possibility of unburned gases. Automatic control assures uniform heating and annealing on a predetermined cycle.

Annealed strip in coil form may



Courtesy of
CINCINNATI GRINDERS INC.
OPERATION: Finish Grind Lynite Pistons
MACHINE: No. 2 Cincinnati Centerless Grinder
WHEEL SPEED: 1236 R. P. M.
WORK REVOLVES: 130 R. P. M.
STOCK REMOVAL: .015 Inch
CUTTING SPEED: 6400 S. F. P. M.
TOLERANCE: Plus or minus .001 inch
COOLANT: 1 part SUNOCO to 60 water

Tolerances to the Nth degree . . . finishes that rival mirrors . . . faster stock removal . . . slower wheel wear —SUNOCO makes them all possible and then some! It cools the work rapidly . . . washes away chips . . . protects parts from rust.

Test SUNOCO . . . learn why leaders say "long live the grinding wheels . . . thanks to SUNOCO."

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be tempered in either of two 4 high 20½ and 48 x 84-inch temper mills, each handling 16 to 22-gage material, 18 to 77 inches in width or sheets up to 20 feet in length. Coiled strip can be handled at 200 to 450 feet per minute and sheets at from 150 to 450 feet per minute. A third mill of the same type is available for cut sheet alone. This handles 14 to 22-gage sheets, 18 to 77 inches wide in lengths up to 20 feet.

A fourth temper pass mill, 32 x 84 inches, is available to handle either coils or sheet, 14 to 22 gage, 18 to 77 inches wide, in coils up to 54 inches outside diameter or sheets up to 20 feet in length. Piler at this mill is preceded by a 4-high roller leveler instead of a 2-high leveler as used at other three temper mills.

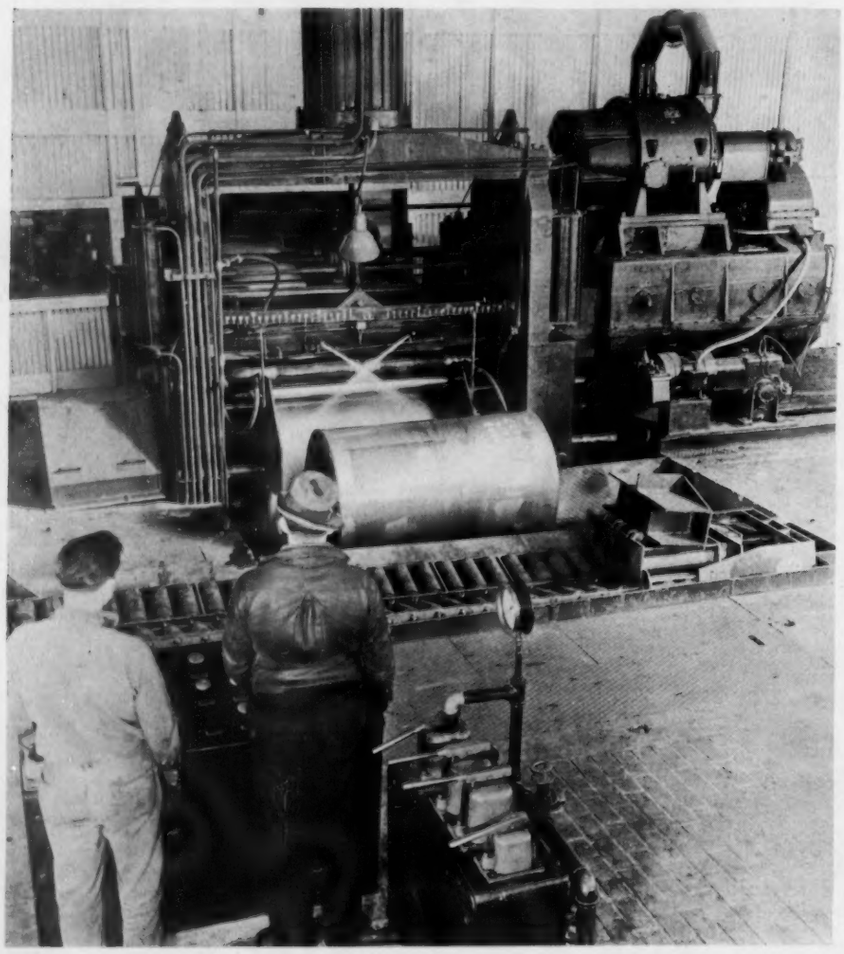
Coils from temper mills may be cut into finished sheets in a special shearing line. A cone type motor driven uncoiler delivers the strip through a 15-roll, 2-high roller leveler to a new type, reciprocating flying shear. This shear will cut material ⅛-inch thick or lighter into lengths ranging from 30 to 180 inches. Knives are synchronized with strip speed which ranges from 130 to 400 feet per minute.

Cut stock from the temper mills usually passes through a side and end trimming line, including a 4-high roller leveler, before going to the warehouse. Additional squaring shears, roller levelers and oiling machines are available in the shipping department. Two 15-ton cranes, 120-foot span, serve truck and car loading platforms.

Close Co-ordination

The cold reduction division of Irvin works is closely co-ordinated with both the continuous hot mill and the finishing equipment. A visitor is immediately impressed with the layout and with the care exercised to maintain a high standard of quality in the product at all times. Every precaution has been taken to safeguard the equipment and to make working conditions pleasant as well as safe. Ample working space is provided around the equipment. Wide aisles assure prompt, safe and efficient handling of material. Lighting and ventilation were carefully studied. As a result, exceptionally satisfactory working conditions exist throughout the entire plant.

Entry end of 80-inch continuous pickling line showing processing uncoiler



Proceedings of Enamel Institute Forum Issued

■ *Proceedings* of the third annual forum of the Porcelain Enamel institute at the University of Illinois, Urbana, Ill., Oct. 12-14, 1938, have been issued in paper-bound book form by the institute. This 228-page book contains a complete record of the papers presented and verbatim reports of discussions. The subject matter covers a wide variety of current problems in enameling shop practice, laboratory testing and the use of iron and steel for enameling stock.

Copies are available at $2 each from the institute, 612 North Michigan avenue, Chicago. Upon request, copies of *Proceedings* of the first and second annual forums will be included without charge with orders for the present volume. Additional copies of the first and second *Proceedings* can be supplied for 50 cents and $1, respectively.

Bureau Studies Elastic Properties of Cast Iron

■ An optical method for measuring deflection of cast iron transverse test bars up to breaking strength has been developed by the metallurgy division of national bureau of standards, Washington. Deflection is determined by measuring distance between a reference point and a rubber band mounted on the test bar.

Three types of cast iron have been investigated. These were heated to maximum temperatures of 2552, 2732, 2912 and 3092 degrees Fahr. Test bars 1.2 inches in diameter were cast vertically, bottom poured in green sand molds at 180, 270, 360 and 450 degrees Fahr. above the liquidus temperature. Transverse properties were determined by interrupted loading and by direct loading up to the breaking point.

From the data obtained the total, plastic and elastic deflections, modulus of rupture, relative modulus of elasticity, total, plastic and elastic resilience were determined for all test bars investigated. In general, lowest and highest elastic properties were observed for the maximum heating temperatures of 2552 and 3092 degrees Fahr., respectively. These properties tended to decrease with the increase of pouring temperature.

In an examination of the microstructure of the test bars, comparatively fine graphite particles were discovered. A laminated, pearlite-like structure and the presence of large graphite particles subdivided into hexagonal grains were observed on some unetched specimens.

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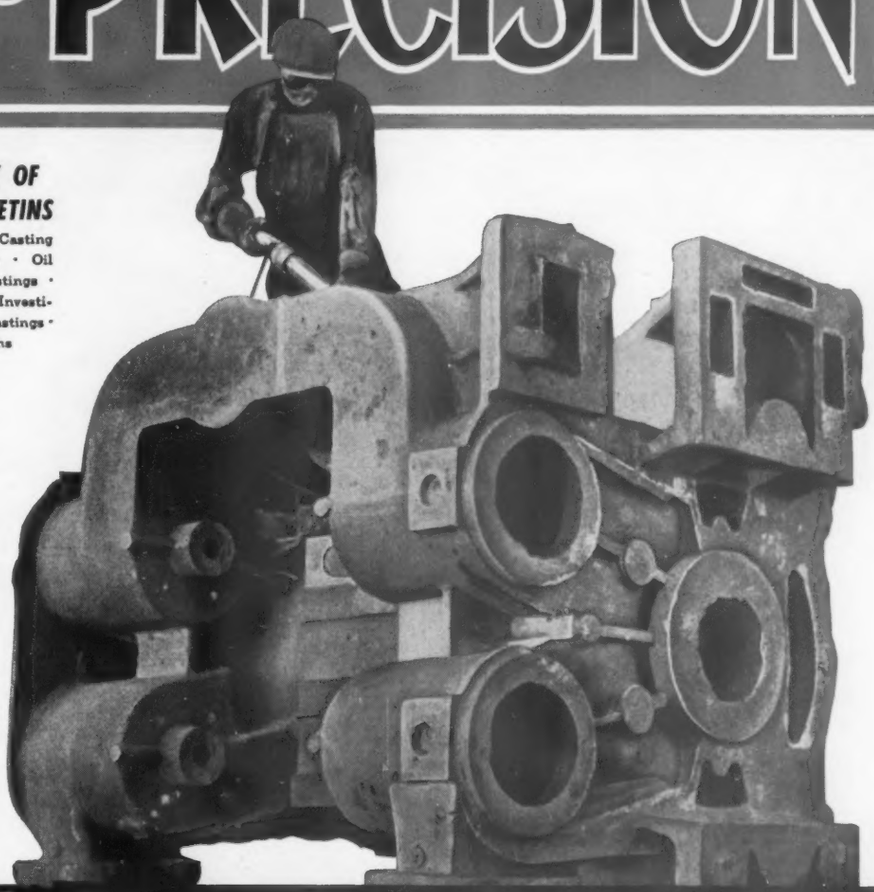

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Cincinnati Grinders Incorporated	Cincinnati, Ohio
The Cincinnati Milling Machine Co.	Cincinnati, Ohio
Fulton Foundry & Machine Co.	Cleveland, Ohio
The Stearns-Roger Mfg. Co.	Denver, Colo.
Atlas Foundry Co.	Detroit, Mich.
General Foundry & Mfg. Company	Flint, Mich.
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Barnett Foundry & Machine Co.	Irvington, N. J.
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Cooper-Bessemer Corporation	Mt. Vernon, Ohio
Vulcan Foundry Company	Oakland, Calif.
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M. H. Detrick Co.	Peoria, Ill., Newark, N. J.
Florence Pipe Foundry & Machine Co. (R. D. Wood Company, Selling Agents),	Philadelphia, Pa.
Warren Foundry & Pipe Corp.	Phillipsburg, N. J.
Rosedale Foundry & Machine Co.	Pittsburgh, Pa.
American Laundry Machinery Co.	Rochester, N. Y.
Banner Iron Works	St. Louis, Mo.
Valley Iron Works	St. Paul, Minn.
Australian Meehanite Metal Co., Ltd.	Waterloo, N. S. W.
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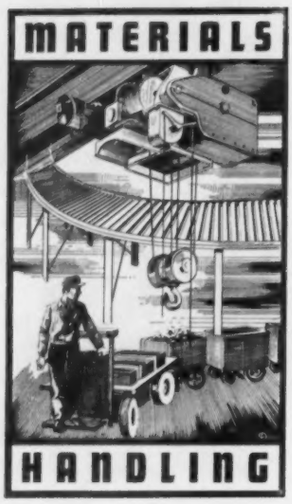


Electric Motor Cores

Unique system efficiently handles 26,000 pieces per hour, the output of one machine. Operator needs only to unload stacked disks, requiring minimum amount of labor. Entire setup synchronized with press for automatic operation

Part I

AT THE SMALL-MOTOR plant of Westinghouse Electric & Mfg. Co., Lima, O., a wide variety of electric motors are made in fractional-horsepower sizes for use on washing machines, vacuum cleaners, electric fans, electric refrigerators and similar items. Since all of this manufacture is of the high production type, all operations necessarily have been arranged on a high production basis.

Stamping rotor and stator core laminations for these motors is one of the most important parts of the manufacturing operations and much thought has been given to arranging equipment and operations for maximum efficiency.

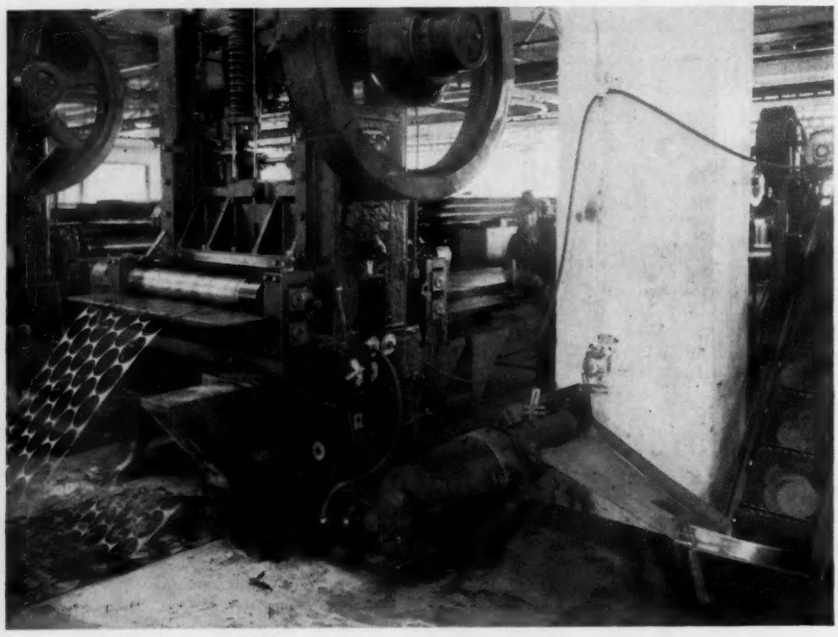
Core laminations 3 inches in diameter and smaller are made from coils of strip, which are fed into an automatic press with progressive dies, some of which produce as many as 4000 pieces per hour. This strip is usually 0.017 or 0.025-inch thick. A typical item produced on these small, high speed presses are the laminations for motors which are being used in electric razors. Fig. 1 is a view of narrow strip going through one of these presses which is making laminations for small electric razor motors. Some of the completed laminations are being held by the operator in this picture.

The core laminations, 3½ inches and larger, start from large sheets. No matter what the size of the core laminations may be, they all start from a sheet 33 inches wide. These sheets are either 0.017 or 0.025-inch thick. They are first fed into what is called a cookie press, shown in Fig. 2. As will be noted, the cookies or disks, which will be later punched to form core laminations, are stamped out from the sheet using dies and feeds so arranged as to form a continuous skeleton with disks just clearing each other. In this manner the maximum amount of the sheet is used and minimum skeleton material is discarded.

Dies for the cookie press are arranged to punch various numbers of cookies per stroke according to the size of the cookie disks being

Fig. 1—Small, high speed press uses steel strip. Small motor rotor laminations stamped out are force fed through bottom of press up through skeleton tube delivery duct just below operator's right hand

Fig. 2—Side view of large cookie press with automatic feeds. Disks or "cookies" fall through press onto belt conveyor system synchronized with press



produced. In some of the larger sizes, only five disks are blanked per stroke of the press. In other sizes, seven or nine may be formed at one stroke. After each stroke, the feed mechanism indexes automatically to place the sheet in the correct position for the next stroke of the press. Feed is thus automatic once the sheet has been gripped by the feed rolls. Feed rolls are installed at both the entrance and exit side of the press.

As will be seen in Fig. 2 the disks blanked from the sheet fall through the press onto a belt conveyor which extends underneath the press. This conveyor is in a number of sections, the first lifting the disks from under the press out to one side where they are dumped into a chute feeding a second belt conveyor, also shown in Fig. 2. These conveyors are of the slat type with slats mounted crosswise the belt at intervals, the disks being lifted by these slats as the belt moves upward.

Automatic Stacking

Several rather unique features are incorporated at the delivery end of this conveyor. In Fig. 3 is shown the automatic mechanism at the end of one of these conveyors where the disks are stacked automatically. This is another time-saving feature which has been found of great merit as a forward step in complete mechanization of all handling processes. The cookie disks come up the conveyor at a great rate since the cookie press, punching six pieces, 6 inches in diameter at one stroke or an equivalent number of smaller pieces, operates at about 72 strokes per minute. This is 4320 strokes per hour which means that 25,920 disks are delivered at the end of this conveyor each hour.

Sorting and stacking this quantity would be a tedious operation if done by hand. Thus the automatic stacking setup is of great value. A closeup of this mechanism, seen from the rear in Fig. 3, will be found in Fig. 4. Disks are dumped into a chute at top of the conveyor, this chute being shaped to form a spout as can be seen clearly in Fig. 4. The spout delivers disks on edge to a pair of rapidly revolving shafts which are threaded to carry the disks to the right in Fig. 4. These shafts are revolved by a small motor seen at the left in this view. The disks delivered at the right of the screws form themselves automatically into a stack. A spring-loaded end weight maintains the stack on edge while it grows larger.

With this equipment the operator simply picks up the completed stack as it grows and places it on the truck skid as shown in Fig. 3. These

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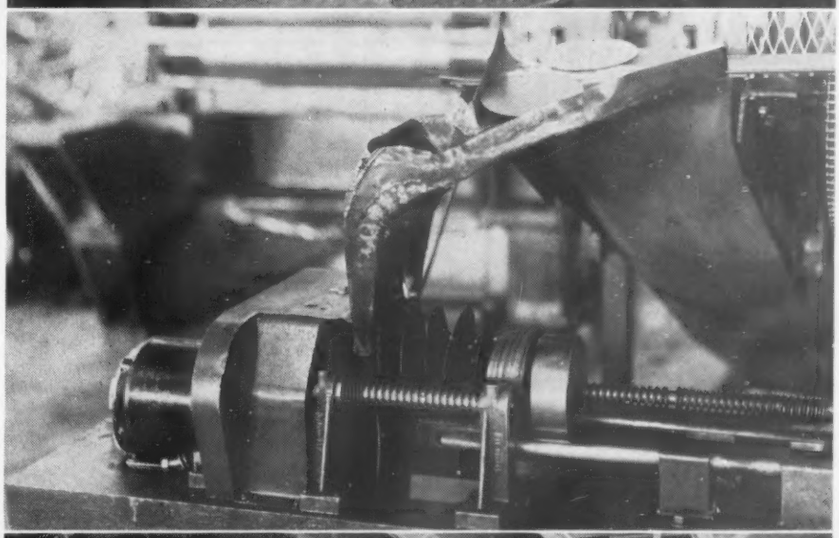

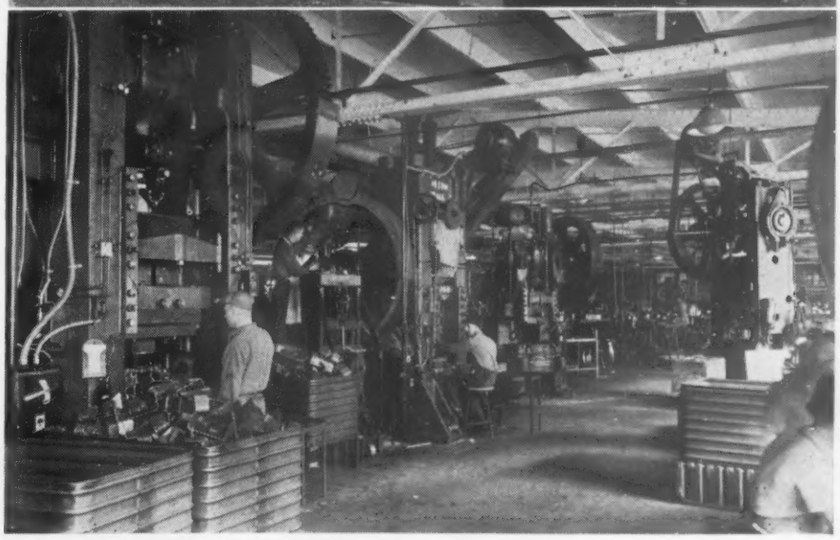

Fig. 3. (Top)—Delivery end of the conveyor system from the cookie press. Note network of tramrails covering storage areas in back. Fig. 4. (Center)—Closeup of the automatic stacking machine at discharge end of the conveyor in Fig. 3. Fig. 5. (Bottom)—Other presses in press shop. Parts are handled in large steel tote boxes

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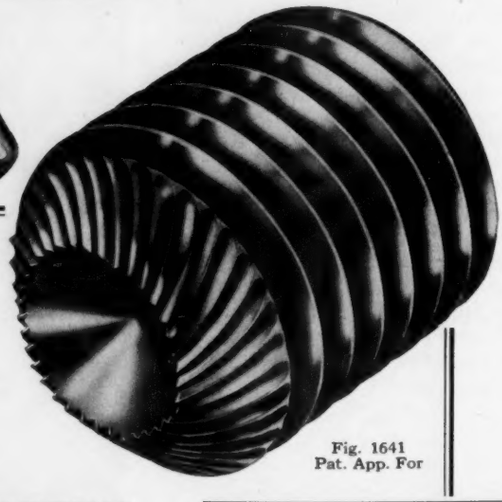

Fig. 1641
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Fig. 1646
Pat. App. For

Large Pot Chuck

Advances in heavy machine tool equipment are evident in unusual circular chuck of welded structural steel. It is part of a machine tool which accurately cuts gears to rotate battleship turrets

■ RECENTLY Camden Forge Co., Camden, N. J., purchased a welded steel pot chuck, 33 feet 7 inches in outside diameter, 3½ feet high, weighing 96,200 pounds. It will be used in slotting the teeth of forged internal gears which rotate the turrets supporting a group of three 16-inch guns on battleships. Possibly the largest pot chuck ever built, it was designed and fabricated by Lukenweld, Inc., division of Lukens Steel Co., Coatesville, Pa., in collaboration with the engineers of Camden Forge Co.

Design, fabrication, transportation and installation of the pot chuck involved some unusual and difficult problems. Because of the accuracy required in slotting turret, ring-gear teeth, rigidity was of primary importance. Preliminary design for the chuck was based on production in cast iron. While one-piece construction was preferable, in redesigning for welding, it could not be employed because of the impossibility of shipping such a large structure. It appeared most practical to use a design comprised of two half sections and two loose central spokes, fabricated separately and shipped to Camden for the welding together of the sections.

Box Sections Employed

To provide added torsional rigidity, box sections were employed. Each of the 12 spokes consists of two channel members, formed on a press brake from steel plate, ⅝-inch thick. The two channel members of each spoke then were butted together on their edges and welded on both sides along their full length of 13 feet 2 inches to form a box 10 inches wide, tapering from a height of 17 inches at the hub down to 8½ inches at the circumference of the ring to provide clearance.

Spokes Internally Welded

To permit internal welding, elliptical openings were flame cut in the sides of the spokes. At the circumferential end of each spoke and from the main web of the pot chuck, sections were removed by flame cutting to bring each spoke through the main web and permit the use of a full strength joint in welding the spokes to the main web. If spokes were welded to inside of the main web, it would have been necessary to make all of the welds internally in confined space at those points and through small access holes cut in the spokes. Obviously, such welds would lack the efficiency of the full strength joints deemed necessary and obtained with the design used.

Twelve segmental spacers fitting between the spokes also were formed in one piece from steel plate ½-inch thick on a press brake. Each spacer is a three-quarter box section with one side open but with the edges flanged down to a depth of 2 inches. Spacers were 10 inches, wide, 10 inches high and approximately 4 feet 4 inches in length. Ends were trimmed by flame cutting at the angles required to fit between the radial spokes.

Forming a transition member, central hub section rigidly ties ends of radial spokes into center or innermost ring, which was formed in halves. The two pieces of the in-

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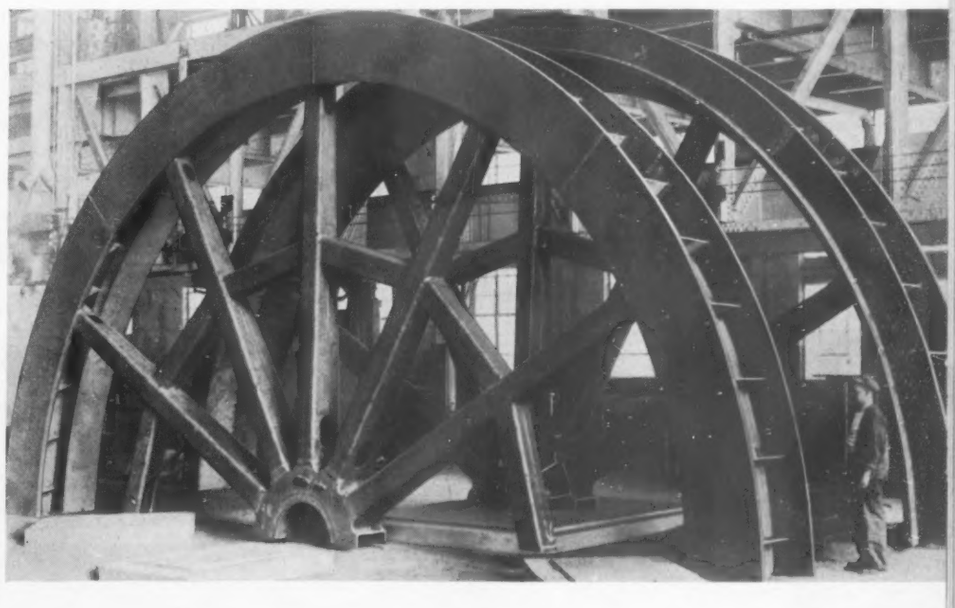


These two half circles form a welded steel pot chuck, 33 feet 7 inches in diameter and weighing 96,200 pounds. After shipment, pieces were assembled by welding together the two halves and two loose spokes to make the complete unit

Auto Headlamps

Torpedo type headlight shells are produced by deep drawing flat sheets in a highly efficient stamping and forming setup. A series of steps first is formed. Then these are smoothed out in hydraulic press after approximate shape has been attained

■ INTERESTING manufacturing operations connected with the production of lamps for automobiles are found at Anderson, Ind., in the plant of Guide Lamp division of General Motors Corp. Here a wide variety of head lamps, tail lamps, parking lamps and license plate illuminators are made.

The ultra-streamlined torpedo-shaped headlamps featured on numerous models of Pontiac and other General Motors' cars are stamped and formed from flat sheets to the torpedo shaped contour. This is done in a number of successive drawing operations which finally result in a total depth of draw of about 12 inches with diameter of the shell being reduced from 18 to about 8 inches during drawing.

Details of these operations follow: First operation is to blank the disks subsequently formed. These are 17⅛-inch diameter circles. These blanks come to the first forming press in wooden, steel-lined boxes. Operator removes a blank from the box and places it in the press for the first operation. The flat disk is made into a large cup and diameter is reduced about 40 per cent. From 17⅜ inches the diameter is now 9¾ inches inside the cup which is 6 inches deep. There is about a 1-inch flange or lip around the outside edge of the cup as shown at B in Fig. 1.

As the top die of this forming press rises from the work, the operator has already gripped another blank ready to place it in the press and he hooks the edge of this blank under the formed piece, lifting it out of the bottom die and shoving it back out of the press where it falls in a chute leading to the operator's position at the second press.

Consecutive Forming

Operator at the second press picks up the piece from the chute, places it in his machine where the work is given the second draw. In this operation the cup is given a deeper form as the diameter is reduced to 8 inches and depth increased to 7¾ inches as shown at C, Fig. 1. Operator here follows same procedure as first operator; that is, after forming he removes the work from the press by hooking a new piece under the lip and raising the work from the lower die. This is followed by pushing the formed piece through the press into a chute at the back which delivers the work at a point where the third operator can easily reach it. The arrangement of presses which makes this possible is diagrammed in Fig. 2. It will be noted that working side of each press is alternately at right and left of the line.

In the third press, the work receives a forming operation which places a step on the side making a double cup. This step is about 6 inches long and 6¼ inches in diam-

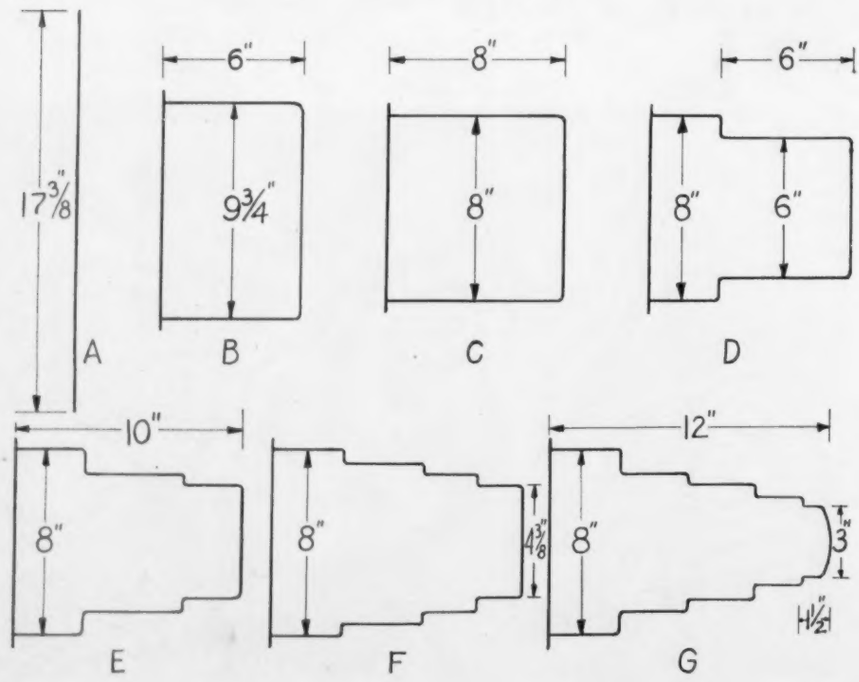
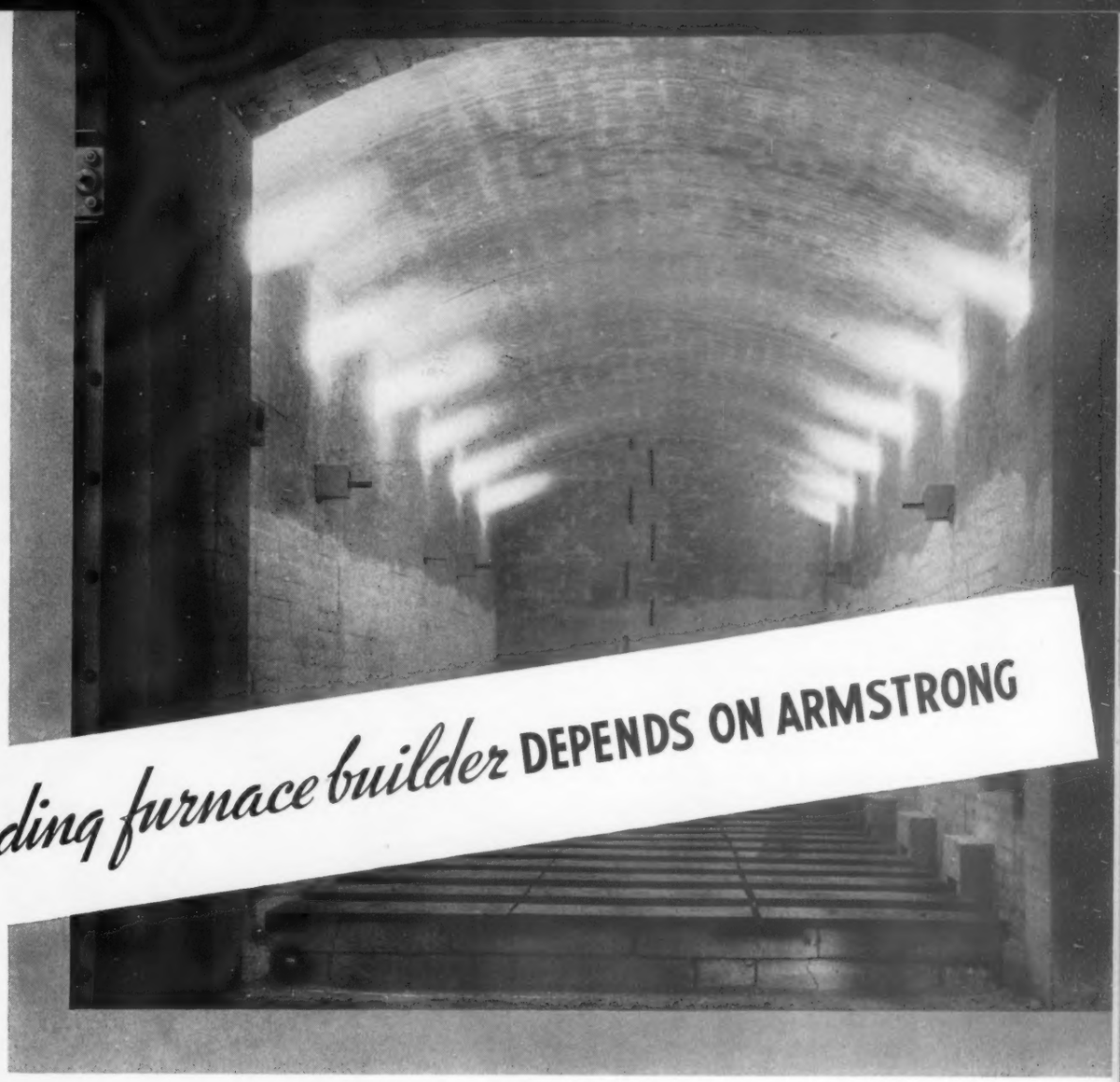


Fig. 1—Various stages in producing the streamlined torpedo shaped headlight shell. Not to scale

...strong's Insulating Fire Brick ... fuel costs and increase the ...rall efficiency of this oil-fired ... Hearth Stress Relieving Fur... installed for Landis Tool Co. ... "Hurricane" furnace, like the ... others shown below, was ...nufactured by the Philadelphia Drying Machinery Company.



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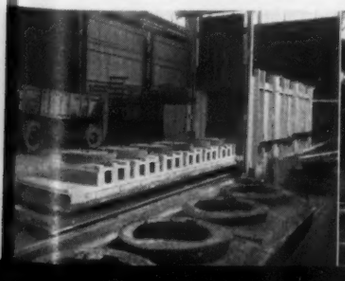
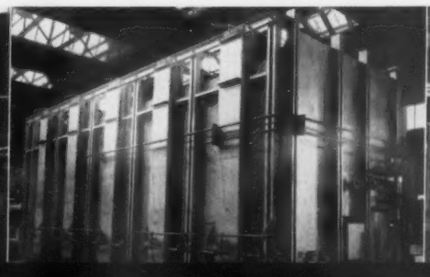
INSULATING FIRE BRICK
HIGH TEMPERATURE BLOCK
PLASTIC CEMENTS
DIATOMACEOUS EARTHS

Another oil-fired, Car Hearth Bright Annealing Furnace, is efficiently insulated with Armstrong's EF-22 Brick. Furnace built for Rotary Electric Company.

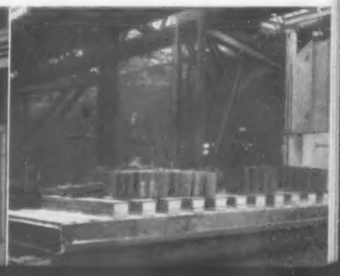


Rear view of large Car Hearth Stress Relieving Furnace—gas-fired, insulated with Armstrong's EF-22 Brick. This furnace installed for the Keeler Boiler Company.



Battery of three heat-treating furnaces charged by manipulator. Two are insulated with Armstrong's EF-22 Brick and one with EF-26 for the Key Company.

Armstrong's EF-22 Insulating Fire Bri... assure maximum insulating efficiency ... this oil-fired, Car Hearth Annealing Fu... nace, installed for Farrel Birmingham



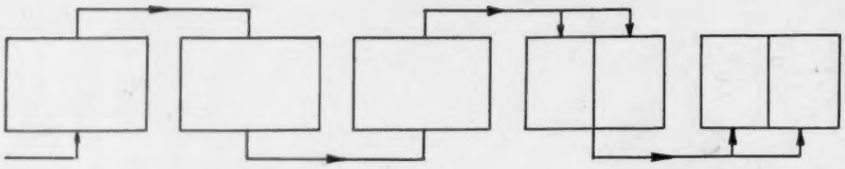


Fig. 2—Arrangement of presses handling the work

eter as shown at D, Fig. 1. In the fourth press, a second step is formed to produce the shape seen as E, Fig. 1. The second step is 4 inches long and 5¼ inches in diameter and total length or depth of the piece is now about 10 inches. The fourth press which forms this last step is a 2-stage press; that is, it has two working positions and two sets of dies. In the second set of dies in this press, another step is produced on the work, this last being 2 inches long and 4⅜ inches in diameter, see F, Fig. 1.

End Is Rounded

The work is now assuming a shape somewhat resembling the headlamp shell. In the fifth press, two operations also are performed as this is a 2-stage machine with two sets of dies. In the first stage, still another step is formed on the end of the shell, this last step being about 1½ inches long and 3 inches in diameter. In the second set of dies on this press a 1½-inch radius is formed on the end of the shell. The work now is about 12 inches long and 8 inches in diameter at the largest step with succeeding steps down to 3 inches in diameter at the end as shown at G, Fig. 1.

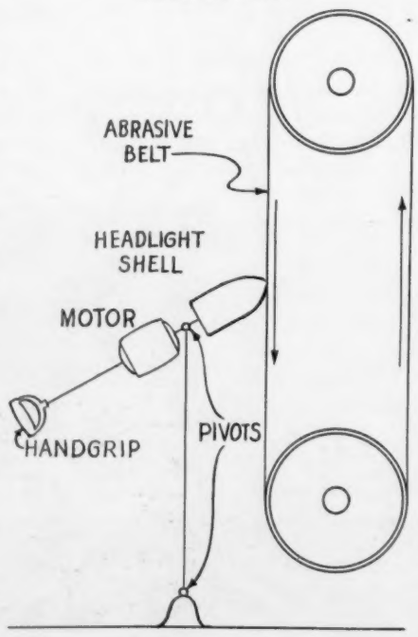
These operations are handled in a row of five presses as indicated in Fig. 2. Production on this line ranges between 450 and 500 pieces per hour. The operator at the last press in this row does not dump his work into a delivery chute as the other operators have done, but hangs the piece on a chain conveyor which takes the work through an annealing furnace. The length of this furnace and rate of travel through it are such as to produce a temperature of 1400 degrees Fahr. in the work for about 5 minutes. This thoroughly anneals the steel and prepares it for the final forming operation.

Coming from the furnace, work is transferred to another chain conveyor which carries it to a pickling bath. Pieces are now ready for the final forming operation which is done on a 200-ton hydraulic press. A piece is set in the lower die and the press tripped to slowly form the work to the final beautifully streamlined torpedo shape seen on the latest model General Motors' cars. The steps formed in drawing are smoothed out in this operation and no evidence of them can be seen in the finished piece except for a barely perceptible ring where each corner was. Even these rings, however. are removed in the final finishing operation. The final diameter is 8¼ inches at the largest point and the pieces are 12⅜ inches long.

From the hydraulic press, pieces are placed in a chute which carries them to another press where the excess flange is trimmed off. From this point the shell passes through a number of rolling operations which produce the slight bulge just inside the opening and which flange the edges of the opening to receive the headlight reflector and lens mounting. These various flanging and rolling operations are done on a number of machines set in line alongside a belt conveyor with dams at each working stage. When an operator has completed his work on a piece he places it on the other side of the dam in direction of belt travel, the belt then carrying the work to the next stage where the dam at that stage holds it until the operator is ready for it.

From flanging and final rolling operations, the shell goes to a special polishing setup which produces a perfectly smooth surface and which removes all forming marks. This setup, graphically shown in Fig. 3, includes several rather unusual features. It is most essential that the grain produced by the polishing operation shall be parallel to the length of the shell.

Fig. 3—High production setup for polishing the shells



This is accomplished by a unique mounting, specially developed to handle this work. Then the shell is placed on the end of a motor-driven shaft which in turn is pivoted from a lever, the other end of which is pivoted at the floor level. There is a handle extending back from the motor and drive mechanism which holds the shell. The operator by gripping this handle can so move the shell against a vertically traveling endless sandpaper belt as to contact all portions of the shell.

Since there is a motor turning the shell, at a constant speed, it is easy for the operator to obtain a uniform polishing action on the shell.

Finishing of these shells is handled in two operations. In the first machine the endless abrasive belt is made of emery paper, grade 2/0-100. In a second polishing operation, the abrasive belt is emery paper of 150 grade. Each belt travels over a 12-inch diameter pulley which, being revolved at 750 revolutions per minute, produces a rather high belt speed. The work comes from these operations very smooth and with all the abrasive marks lengthwise of the shell which aids production of a perfect finish.

From the polishing machines the shells go to horning presses where mounting holes of various shapes and arrangement are produced.

Following operations consist in cleaning, enameling and baking the desired finish on the shell. While only the large head light shells have been described here, a similar setup is employed in producing the tail lamp assemblies and other lamps of smaller size.

How To Avoid Trouble Under Wage-Hour Law

How to Operate Under the Wage-Hour Law, cloth, 248 pages, 6 x 8½ inches; published by Alexander Publishing Co. Inc., New York; supplied by STEEL, Cleveland, for $3.50; in Europe by Penton Publishing Co. Ltd., Caxton House, Westminster, London S. W. 1.

This study of the new legislation is by Alexander Feller of the New Jersey bar and Jacob E. Hurwitz of the New York bar. It is a digest designed for the businessman, charting the course to be followed in adjusting to the new conditions with least trouble and expense. Explanation is in plain terms, understandable by those with no knowledge of legal language.

It is a quick reference to procedure and its arrangement gives immediate access to answers to problems arising in compliance with the regulations.

26th in a series of advertisements designed to help you make a better selection of wire for maximum value per unit of cost.

The kind of coating with which a wire is drawn or finished is often as important from a standpoint of use as for mere looks. For example, costly cleaning or buffing operations may be eliminated in plating and roll slip may be avoided in forming machinery, if the proper finish is specified.

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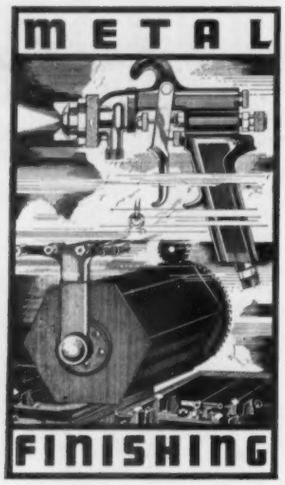


Reflection Factors

In choosing colors for large painted surfaces likely to affect illumination, the eye is often unreliable. Many times it is possible to select equally pleasing colors and yet to have a gain of 10 to 15 per cent in reflecting value

■ USING BOTH mercury and incandescent lighting, comprehensive scientific tests of reflection values from surfaces painted with 21 interior color variations have been made which may aid in choosing tints for best results with various lighting equipment.

Satisfactory painted surfaces free from objectionable specular reflection and in the range of lighter tints can be had with reflection coefficients easily in excess of 60 per cent, according to S. G. Hibben, director of applied lighting of the lamp division of Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Of these tints, some of the greens, blues and grays will show a slightly higher reflection value under mercury illumination but the reverse is true for those tints containing pinks, buffs, tans or reddish colors.

For best lighting efficiency it is important when using mercury vapor lighting to have paints with good reflecting values at the particular wave lengths of light which are normally predominant in the output of the mercury lamp.

In the average interior when using an indirect or semi-indirect fixture, the character of the ceiling is vitally important. If this is a good white, the table top illumination is not greatly influenced by the colors or quality characteristics of the light source.

Long Wave Colors

Paints that under daylight appear to be pink, orange, red or mixtures of these longer wave colors should be avoided as the incident light is deficient in long wave colors. In a mercury lighted interior, the greatest efficiency is experienced if the longer wave paint colors are avoided.

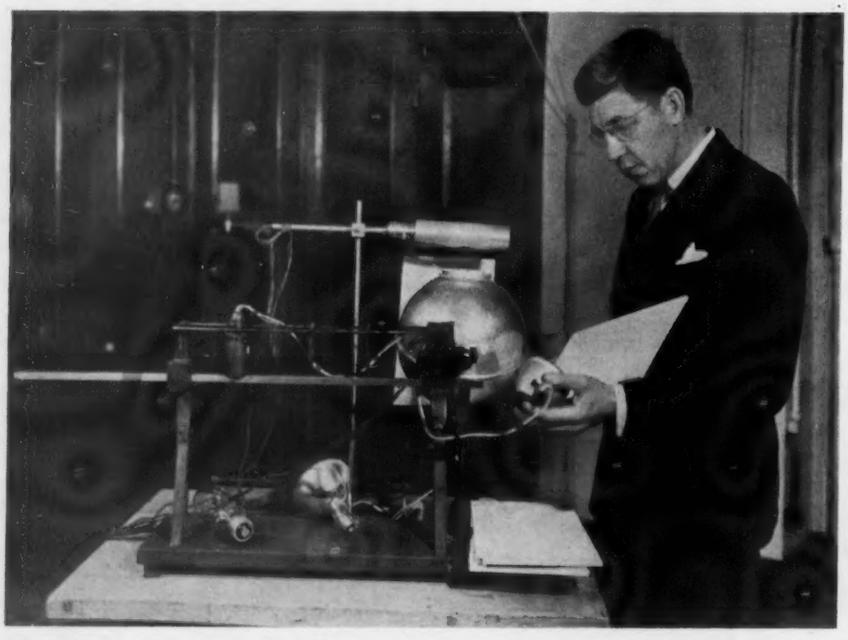
A series of measurements were made on 21 typical tints of painted surfaces, corresponding to commercial conditions. The basic standard of comparison was a surface of magnesium carbonate having the reflection coefficient of 98 per cent. The illumination from the filament lamp used corresponded to the medium wattage Mazda lamps found in average stores or offices. The mercury illumination was from a standard 250 watt, high intensity, mercury vapor lamp at about one-half atmospheric pressure, operated at a stable temperature and a normal rating. Illumination in all cases was diffuse.

Tests indicated that of the total average of 21 specimens, the coefficient of reflection under Mazda illumination is about 2 per cent less than under mercury illumination. See Tables I and II.

Reflective Values

To determine comparative reflective values, the 21 tints were divided into three groups of seven samples each, a reflective coefficent group above 75 per cent, a group from 60 to 74 per cent, and a third group from 45 to 59 per cent. Under incandescent examination, the first group with whites, ivory and light buff shades averaged 0.793. The second group contained light pinks, tans, blues and greens and averaged 0.644. The third group with darker grays, greens and blues averaged 0.534.

Under mercury lighting, the groups shifted with only whites and ivory remaining in the first division for an average of 0.828. Ten tints were incorporated in the second group for an average of 0.659. The third group, with seven tints, had an average of 0.550. Regardless of this shifting, however, the averages for each of the three mercury



Here Mr. Hibben is shown with the reflectometer used in the tests described. Numerous measurements were taken on each specimen to get an accurate average and to minimize human inaccuracies

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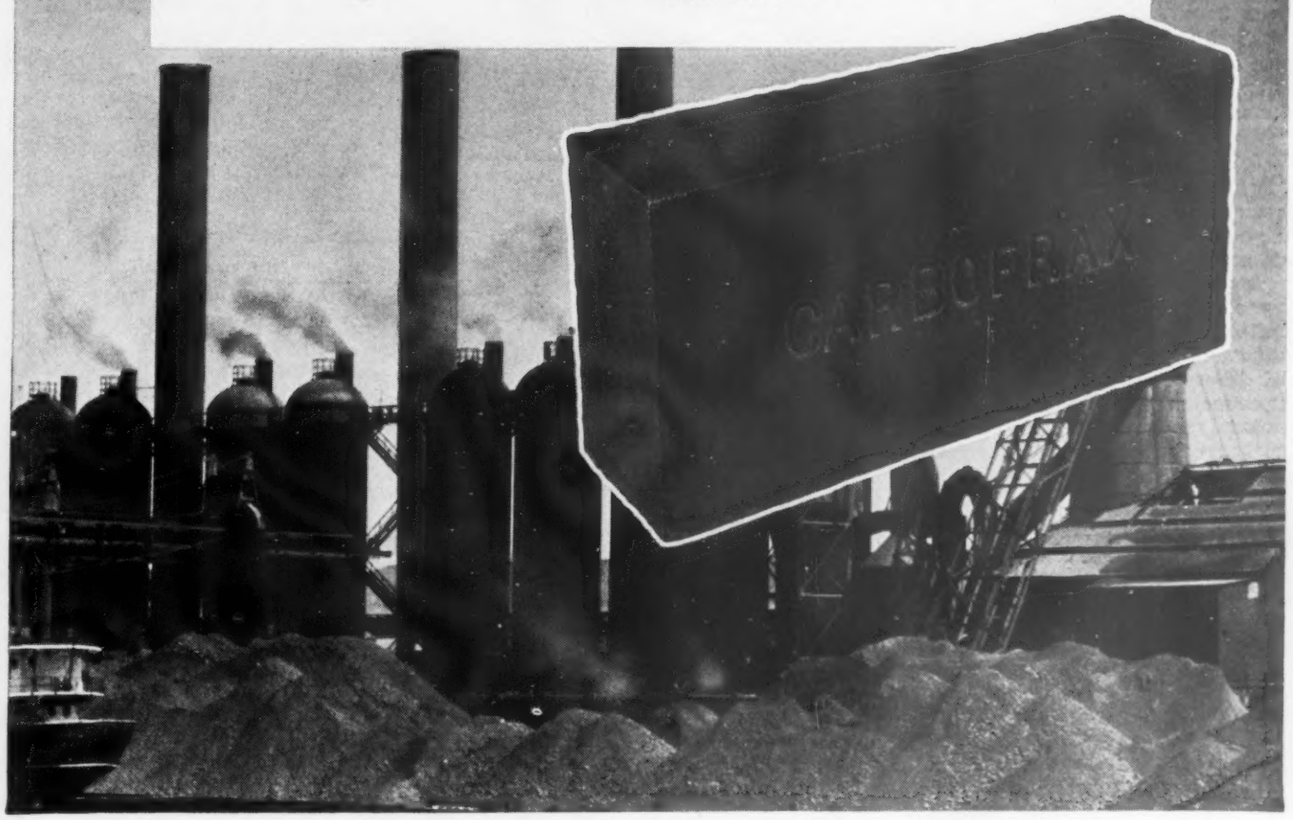

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(Carborundum and Carbofrax are registered trade-marks of The Carborundum Company)

TABLE I—Reflection Factor

Finish	Mercury Light	Mazda Light
Interior Satin White	.87	.85
Semigloss White	.86	.82
Interior Flat White	.81	.82
Ivory Semigloss	.77	.78
Suntone Satin	.72	.75
Light Buff Satin	.70	.78
Interior Satin Peach	.70	.72
Interior Satin Ivory	.69	.75
Satin Sea Foam Green	.66	.62
Sky Blue Semigloss	.66	.63
Dawn Gray Satin	.62	.57
Horizon Blue Satin	.62	.60
Blossom Pink Satin	.62	.67
Orchid Satin	.60	.64
Maize Tan Satin	.58	.63
Beige Satin	.58	.59
Apple Green Semigloss	.58	.57
Mist Gray Satin	.55	.53
Satin Cascade Blue	.55	.52
Palmetto Green Satin	.52	.49
Spring Green Satin	.49	.47

groups were in each case slightly higher than the corresponding Mazda section.

Inasmuch as all the specimens were of light tints, their ability to reflect light would not be radically different when illuminated by light of different quality. On the whole, specimens of white and near-white colors may reflect light from the mercury lamp to a slightly greater degree than from the tungsten lamp, but the reverse would be found with more nearly saturated colors such as red and orange.

The continuous spectrum of the filament lamp is relatively deficient in the short-wave colors or the blue-violet end of the spectrum. Light from the mercury lamp is changeable but is chiefly concentrated at blue, yellow, green and bright yellow.

In choosing colors for large painted surfaces likely to affect illumination, the eye is often unreliable. Selection should not depend on eye observation alone. Often it is possible to select equally pleasing colors and yet have a gain of 10 to 15 per cent in reflecting value.

With modern lighting equipment that in most commercial structures directs much of the light to the ceiling, areas above the general level of the picture molding should have reflection values of 80 per cent or higher. A general guide for interior colors may be found in nature's outdoor scheme, with the brightness of the horizon zone roughly half that of the sky, and the lower foreground half the brightness of the horizon. Presumably one would be on the right track to choose a ceiling paint of flat white or near white of about 85 per cent. The upper wall surfaces would have a reflection coefficient of about 45 per cent, and the lower walls and floors would be about 20 per cent.

TABLE II MAZDA ILLUMINATION

75% Up Group		60-74% Group		45-59% Group	
Satin White	.85	Satin Peach	.72	Beige Satin	.59
Flat White	.82	Blossom Pink	.67	Dawn Gray	.57
Semi-Gloss White	.82	Orchid Satin	.64	Apple Green	.57
Ivory Semi-Gloss	.78	Maize Tan	.63	Mist Gray	.53
Light Buff Satin	.78	Sky Blue	.63	Cascade Blue	.52
Suntone Satin	.75	Sea Foam Green	.62	Palmetto Green	.49
Satin Ivory	.75	Horizon Blue	.60	Spring Green	.47
Group Average	.793		.644		.534

MERCURY ILLUMINATION

Satin White	.87	Suntone Satin	.72	Maize Tan	.58
Semi-Gloss White	.86	Light Buff Satin	.70	Beige Satin	.58
Flat White	.81	Satin Peach	.70	Apple Green	.58
Ivory Semi-Gloss	.77	Satin Ivory	.69	Mist Gray	.55
		Sea Foam Green	.66	Cascade Blue	.55
		Sky Blue	.66	Palmetto Green	.52
		Dawn Gray	.62	Spring Green	.49
		Horizon Blue	.62		
		Blossom Pink	.62		
		Orchid Satin	.60		
Group Average	.828		.659		.550

Total Averages Mazda Illumination = .657 Mercury Illumination = .679

Single-Coat Primer For Rubber Coatings

■ A single-coat, liquid rubber primer coating material that dries cold to a solid surface within an hour and withstands temperatures up to 212 degrees Fahr. has been developed by Self-Vulcanizing Rubber Co., 605 West Washington boulevard, Chicago.

This product is used for bonding liquid rubber to metals, concrete, glass, tile and brick, and used alone it rust proofs and waterproofs various types of surfaces. It is the first coat upon which liquid rubber is applied for rubber-lining acid and pickling vats, tanks, blowers, air ducts, plating racks, filter press plates and subsoil pipes. Primer is said to cover about 250 square feet per gallon.

More Steel Used in Burial Vault Bases

■ Until recently the bases of "air-seal" steel burial vaults were constructed like inverted cake pans, with the narrow edge resting on the ground and acting as the sole support for the casket and steel dome of the vault. This 400-pound weight often caused the narrow rim support to cut into the earth. To correct this condition Galion Metallic Vault Co., Galion, O., has redesigned its line of vault bases to make them nonimbedding.

These bases are constructed with heavy steel plate over the entire bottom, all of which contacts the earth and serves to support the casket and steel dome of the vault. From 30 to 40 more pounds of steel is used in each of these new bases than was used in the old type.

German Text on Molding Machine Use in Foundry

■ *Machine Molding* (Maschinenformerei), by U. Lohse; paper, 64 pages, 6 x 9 inches; published by Julius Springer, Berlin, Germany; supplied by STEEL, Cleveland; in Europe by Penton Publishing Co. Ltd., Caxton House, Westminster, London S. W. 1.

Printed in German, this volume is one of a series of workmen's handbooks and discusses in detail various phases of molding by machine. It covers principles of molding machines, machines employing some hand ramming, hand squeezer machines, pneumatic squeezers, jolt machines, squeeze-jolt machines, centrifugal sand throwing machines, and special molding processes. Different types of core machines also are described. Final chapter is devoted to a summary and review.

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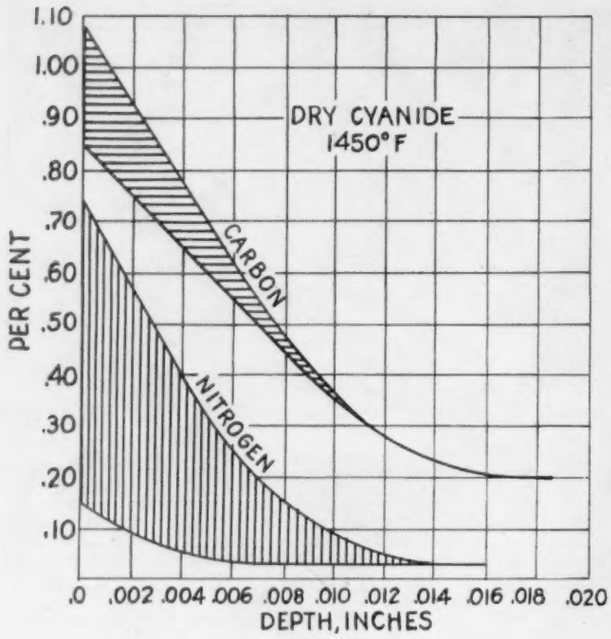
Compounding of Gases In Dry Cyaniding Gives Wide Range of Cases



Range of carbide-nitride cases produced on S.A.E. 1020 steel by varying carburizing gases and proportions of ammonia used in conjunction with them

■ PROGRESS of research on the subject of dry cyaniding (STEEL, Feb. 21, 1938) was outlined by R. J. Cowan, metallurgical engineer, Surface Combustion Corp., Toledo, O., in a recent address on superficial hardening, before members of the Detroit chapter of the American Society for Metals.

Combination of nitriding and carburizing heat treatments to produce thin cases on a wide range of steels is meeting increasing commercial acceptance, but Mr. Cowan pointed out that research work done by his staff has indicated a tremendous range of properties can be produced by slight variations in furnace conditions, proportion of carburizing to nitriding gas, quenching, etc. For example, the accompanying chart shows the range of case compositions which have been produced on S.A.E. 1020 steel by varying the carburizing gases and the proportions of ammonia used in conjunction with these gases.

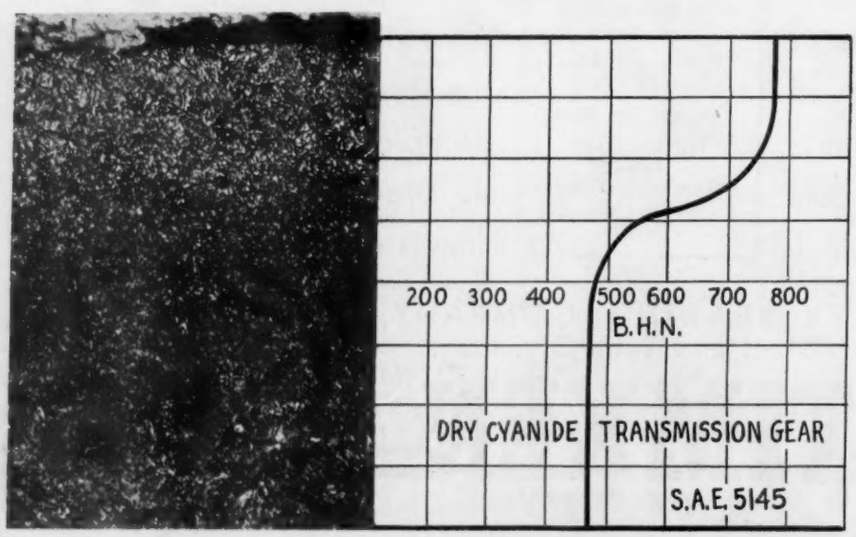
Composition Selected

It is possible, Mr. Cowan observed, to select the desired composition from such a chart and then to compound the gases in such a way as to produce cases of any chosen type in a continuous manner. In these experiments, the proportion of ammonia in most cases averaged well under 30 per cent.

An accompanying photomicrograph and hardness curve shows results of dry cyaniding a transmission gear of S.A.E. 5145 steel. The micrograph was made from a section through one of the gear teeth after it had been subjected to a dynamometer test which was twice as long as the usual life of the test piece. The original magnification is 300 diameters and the original chart is ruled in ½-inch squares. Accordingly the hardness at different depths may be seen by comparison with the adjoining chart-two squares representing a depth of 0.0033-inch.

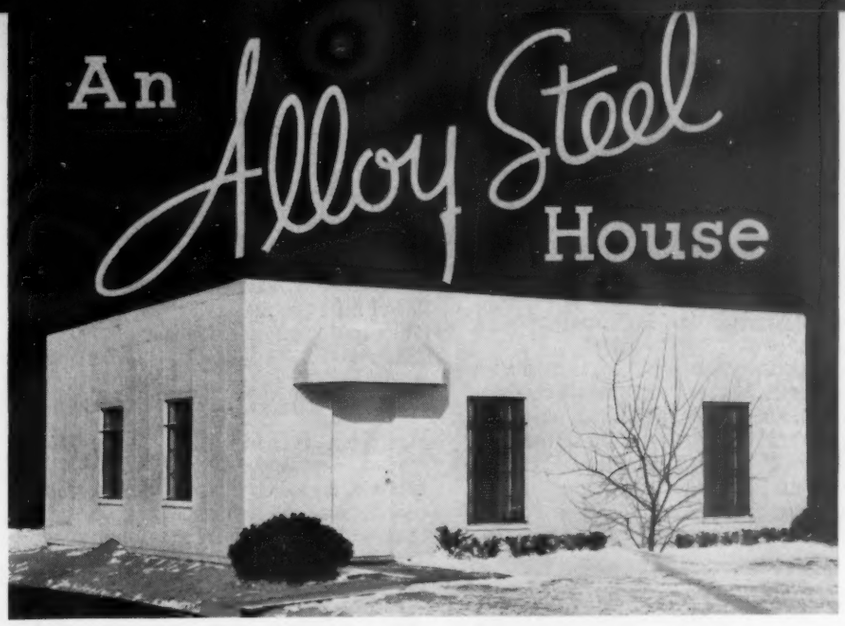
A second photomicrograph shows a structure typical of a slowly cooled specimen which has been produced in such a way as to avoid extreme surface brittleness and objectionable nitride needles. While hardness is not as great as that of a quenched specimen, it is still file hard and suitable for many purposes.

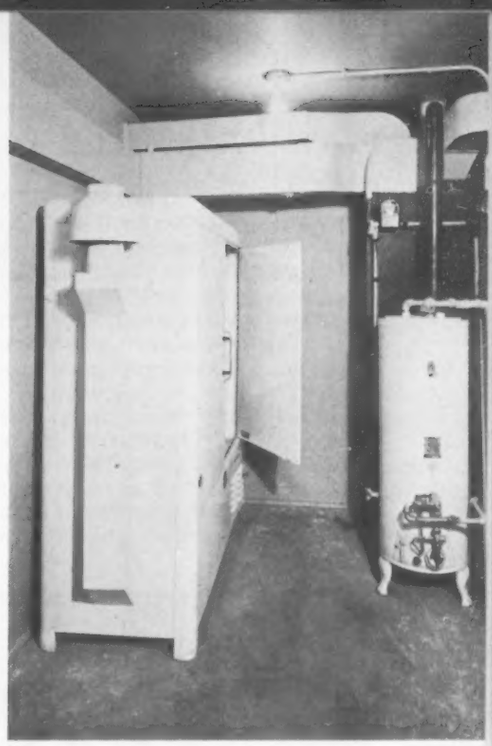
Microstructure typical of a slowly cooled dry cyanided specimen, avoiding extreme surface brittleness and objectionable nitride needles. X300



Illustrating depth of case and microstructure on dry cyanided transmission gear of S.A.E. steel by plotting brinell hardness number at different depths. Two squares on chart are equivalent to 0.0033-inch on the specimen

An Alloy Steel House





Shown above is the completed alloy steel house, a compact dwelling with five rooms and a bath. At the right is the utility room of the new home, comprising the heating plant and automatic clothes drying unit

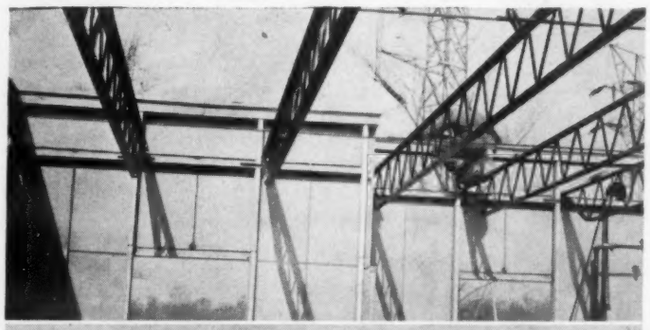
■ DESIGNED to overcome the shortcomings of earlier steel houses and those of wood and masonry construction, a low-cost dwelling of rigid alloy steel construction has been developed by Youngstown Sheet & Tube Co. in cooperation with Book-Reese Realty Co., Youngstown, O. This home will be constructed anywhere in the United States for a standard price of $5000.

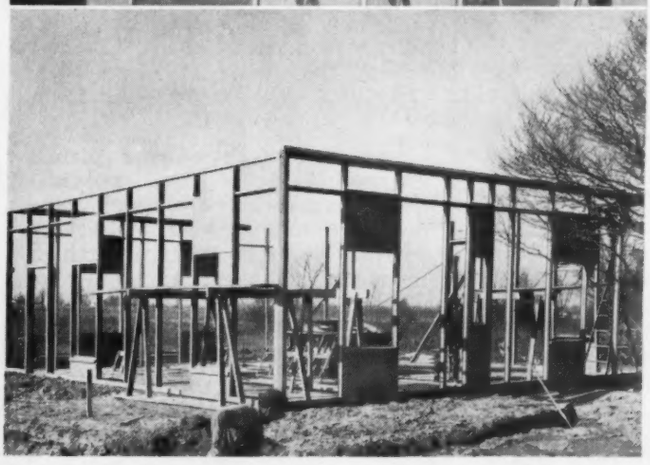
Because a rust-resisting alloy steel, known as Yoloy, is used in its construction, this house is said to be adaptable to any climate or atmospheric condition. It will not corrode, nor warp as does wood, nor dry out as does some masonry. Interior walls are soundproofed with a composition material, eliminating the "clatter" encountered in some earlier steel houses. This effective insulation is a distinct advantage in noisy urban locations.

According to the builders, the rigid steel construction of the new house gives it sufficient strength to withstand theoretical wind velocities up to 300 miles per hour, affording ample protection in earthquake or hurricane zones. By its very nature this type of construction is fire-resistant and is uninteresting to termites. The only wood used is found in the doors and flooring. Being set in a mastic composition through which termites cannot penetrate, floor is amply protected. Layers of air beneath the roof and between the walls provide effective insulation, and modern air-conditioning equipment makes the house suitable for either hot or cold climates.

Since the type of steel used in this construction is little affected by humidity and temperature, time does not loosen nails, causing floors to warp and windows to rattle. In this house 2½ tons of carbon steel are used for the frame, outer wall panels and decorations. Outer walls are painted and may be washed with a hose.

This is a one-story house, without a basement. It has five rooms, including living room, kitchen and dinette, two bedrooms, bathroom, and a utility room combining heater, air conditioning unit, laundry and automatic clothes drying unit. The roof is flat and is designed to serve as a play space for children. According to the architect, this dwelling is intended for the family that prefers the privacy of a single-family house and yet like the compact convenience found in the modern apartment house.





(Left) Steel framework of the new dwelling is designed for simple and inexpensive erection. Bridge type girders give this house high rigidity and storm resistance. (Below) Kitchen and dinette, showing compact, convenient arrangement

Presents Review of the Nickel Industry in 1938

■ General survey of the nickel industry in 1938 has been prepared by Robert C. Stanley, chairman and president, International Nickel Co. of Canada Ltd., Copper Cliff, Ont. Significant figures detailing world production and consumption are outlined. The text is divided into sections according to industries in which new applications of nickel were developed during 1938. Basic nickel products, such as alloy steels, are discussed in another section. Under special products, Mr. Stanley points out increased use of nickel in the coinage of various countries. Copies of this review may be obtained from the company.

Broaching and Machining Lubricant Is Introduced

■ Especially adapted for use in vertical and horizontal broaching machines, and for lathes, a new machining lubricant has been developed by Wayne Chemical Products Co., Detroit, and is being marketed under name of Aqua Sol "C" compound.

This lubricant mixes readily with water, and the average solution is eight to ten parts of water to one part of the base compound. Solution is said to be efficient for cooling purposes and to produce good finishes on parts being broached or machined. Cleanliness of this product eliminates necessity for frequent cleanups around machines.

Insulating Material Is British Meeting Topic

■ British joint committee on materials and their testing is organizing a discussion on "Properties and Testing of Heat Insulating Materials," which will take place Nov. 23 in London in connection with the autumn meeting of the Institution of Gas Engineers.

The discussion will be divided into three sections: (1) High-temperature insulating material; (2) low-temperature insulating material; and (3) insulation of buildings and other applications. It is intended that the papers will review the present position of research and current opinion, not only in Great Britain but also on the continent and in the United States. Considerable interest is evident in this subject.

National Income in United States Analyzed

■ *National Income in the United States*, 1799-1938, by Robert F. Martin; cloth, 146 pages, 6 x 9 inches; published by National Industrial Conference Board Inc., New York; supplied by STEEL, Cleveland, for $3.50; in Europe by Penton Publishing Co. Ltd., Caxton House, Westminster, London S.W.1.

This study offers the most complete estimates of national income in the United States that are available, for the 140-year period beginning in 1799. Since that date income received by individuals in the United States has increased from less than one billion dollars to a peak of almost $80 billions in 1929, falling to an estimated $62 billion in 1938. In terms of goods and services purchasable with the dollars received, the national income per capita increased nearly threefold in the 140-year period.

Sources for each year and period are estimated by kind, salaries, wages, entrepenurial income, dividends, interest and rent, and by industrial origin, agriculture, mining, manufacturing, construction and others.

A chapter deals with the rise of government as a direct source of personal income from 1 per cent in 1799 to a peak of 20 per cent of the total in 1936.

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ONLY ONE QUALITY — THE BEST

More Goods at Lower Prices as Business Aid

■ *Industrial Price Policies and Economic Progress*, by Edwin G. Nourse and Horace B. Drury; 314 papers; published by the Brookings Institution; supplied by STEEL, Cleveland, for $2.50; in Europe by Penton Publishing Co., Ltd., Caxton House, Westminster, London, S. W. 1.

The authors of this study emphasize the need for business executives applying all their ingenuity and experience toward producing more goods at lower prices so that mass consumption may make it possible to attain full economies of mass production.

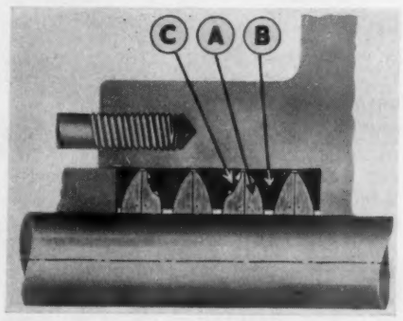
Demand for increased government responsibility for providing employment for the nation's millions of unemployed can be diminished only if employment is provided by private industry. Business obviously cannot afford to go out and hire men unneeded. But numerous industries have contributed much in reducing prices, expanding output and raising the existence level of the people as a whole. Such policies create jobs. The book proceeds from the general analysis developed in a former Brookings Institution publication, *Income and Economic Progress.*

Develops Rod Packing For Severe Conditions

■ A unique type of rod packing, developed by Rodpak Mfg. Co., San Francisco, is specifically designed for severe service conditions. It employs two metal rings, shown in the accompanying illustration as A, the concave on both faces so that they mate with convex faces of the metal rings. Beryllium copper springs (C) are embedded in the Neoprene rings and seat themselves in recesses in the metal rings. These copper springs prevent packing from turning with the rod on centrifugal units. On reciprocating rods, springs are so placed as to exert an inward and downward pressure to offset any irregularity of the rod.

This construction is said to provide a floating seal under all conditions. The metal rings seal the rod but do not touch the stuffing box. Neoprene rings seal the stuffing box but do not touch the rod. As only the metal rings touch the rod, coefficient of friction is low.

A typical application of this type of packing was made on a compressor which handles a combination of hydrogen and nitrogen at a pressure of 170 pounds. Here the new packings lasted ten months, whereas it was formerly necessary to pack the unit weekly. The new packing has been used successfully also on pumps handling emulsified asphalt containing caustic soda and on a pump handling hot kerosene at pressures ranging from 5000 to 8000 pounds.



Cross section of rod packing, showing metal rings (A), Neoprene rings (B) and beryllium copper springs (C) which prevent packing from turning with the rod

sealing medium on the shaft. On some applications these are babbitt metals and on others a metal that will resist up to 700 degrees Fahr. Between these sets of rings are rings of Neoprene (B), which are

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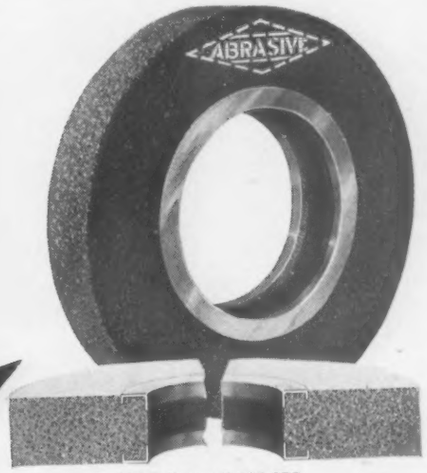

*U. S. Patent 2,121,656

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SIMONDS FAMOUS FAMILY OF METAL CUTTING TOOLS

Consist of two circular steel flanges or plates permanently embedded and bonded into the sides of large hole resinoid bonded wheels adjacent to the center hole and lining a portion of it. Available in wheels with 6" and 12" hole sizes. Write for Bulletin ESA 56 for complete description. Distributors in all industrial centers.

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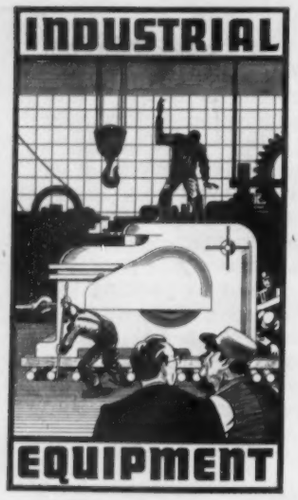
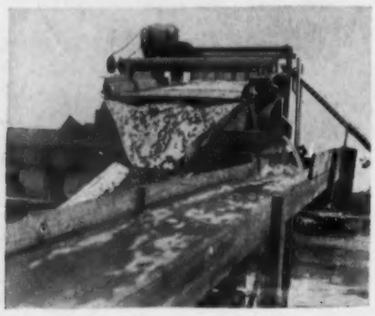


Screen Removes Solids From Waste Water

■ Link-Belt Co., 307 North Michigan avenue, Chicago, has developed a mechanical vibrating screen for efficient removal of solids from factory waste water.

Screen has surface of 2 x 4 feet or



4 x 5 feet and employs fine mesh stainless steel, screen cloth. It is a compact, self-contained unit, furnished complete with steel collecting tank under screen cloth. Motor is 1 or 2 horsepower, depending on size of screen, and is mounted on top of screen's steel framework.

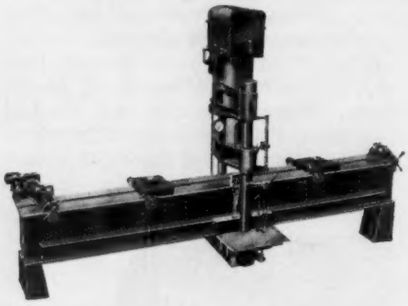
It has been applied at a steel mill for removal of slag that was light enough to float out into stream adjoining the mill's quench pit.

500-Ton Press Built For Government Arsenal

■ A. B. Farquhar Co., York, Pa., has designed and built a 500-ton press for straightening gun barrels and heavy shafting at the Watervliet arsenal.

Press was built in accordance with government specifications. Bed of machine, which is 32 inches wide and 26 feet long, is made of heavy structural steel sections riveted together and machined on top surface for guiding various parts. Pressing unit of machine is of 500-ton capacity supported by means of wheels on bed of machine. Wheels are equipped with roller bearings to minimize friction for movement of pressing section of machine from one end of machine to the other. Press has travel speed of 120 inches per minute.

Press is equipped with revolving mechanism for checking work be-

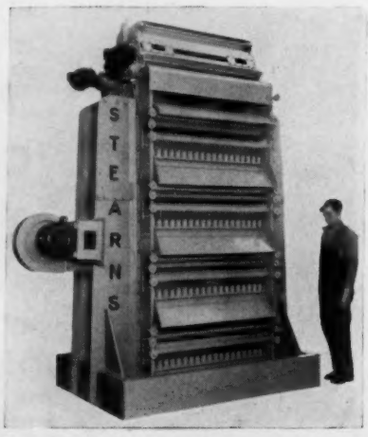


fore and after straightening. End has a motorized unit controlled by means of pendant switch having provision for jogging operation. Straightening operation proper is done on pressure blocks which raise and lower work from revolving heads. Revolving heads and pressure blocks are adjustable with respect to pressing unit. Press has two different speeds which are accomplished automatically at any predetermined set position of moving platen. As a safety device, pit on front of machine is covered with automatic cover which follows motion of pressing unit of machine.

Eliminates Air Gaps in Huge Magnetic Separator

■ Stearns Magnetic Mfg. Co., 620 South Twenty-ninth street, Milwaukee, has built one of the largest magnetic separators ever manufactured, designed for treatment of ore in South American mining operation.

Separator weighs 36,000 pounds, has an overall height of 12 feet and

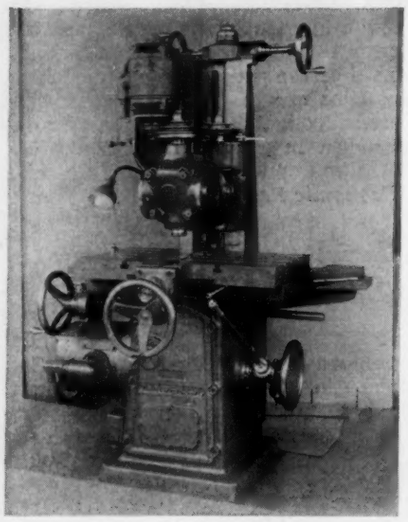


measures 5 x 7 feet at base. Simplicity of design and operating principle, elimination of moving elements such as conveyor belts, rolls, and for reduction of bearings to a minimum are features. Air gaps in separating zones have been eliminated.

Material is fed by an agitated reciprocating feeding element which distributes it in a uniform layer into various separation fields. Rate of flow and point of contact of material with premagnetizing poles is adjustable to permit maximum capacity and highest attainable value in separation by various passages through the magnetic separator.

Introduces Multiple Purpose Machine Tool

■ Hack Machine Co., 440 North Oakley boulevard, Chicago, has placed on the market a multiple purpose machine tool, known as the Multi-Versal, applicable to both reciprocating and rotary cutting. Due



to the built-in reciprocating ram and master head, changes from reciprocating to rotary motion require but the selection of one of two push-buttons. Instantly attachable adapters and heads, fitted to the master head, complete the setup.

Rear ram serves as a vertical column, having a reciprocating motion adjustable from ½-inch to 3½ inches. Master head is a self-contained horizontal milling unit, receiving its power through a V-belt from a motor adjustably attached to it. Six back-geared speeds are provided, suitable for driving cutters ranging in size from a 1-inch end mill to an 8-inch face mill. Master head serves as a carrier for all removable attachments.

Feed screws geared down from the handwheel to permit sensitive movement of the compound table, which measures 18 x 30 inches.

(*Please turn to Page* 81)

ADVERTISING PAGES REMOVED

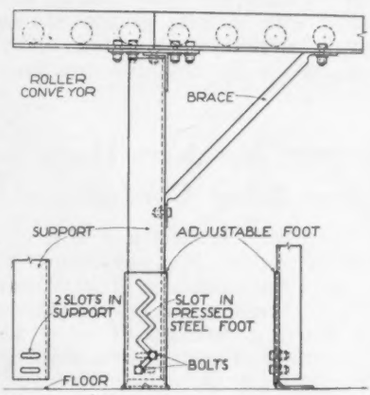
Micrometer dials are provided for longitudinal and lateral movements. Vertical spindle has speeds of 750, 1200, 1800 and 2500 revolutions per minute, and head can be revolved 360 degrees around master spindle.

Combination high speed die filer and slotter is driven from the vertical head or can be attached to the master head. Combination grinder has two spindles, one for a cup-wheel and one for small bore grinding. Removable hacksaw frame slips into place on right side of the master head, and is usually used in connection with the elevated table.

Slot Prevents Conveyor Support from Slipping

■ Logan Co., Louisville, Ky., has announced a new type of adjustable floor support for conveyors.

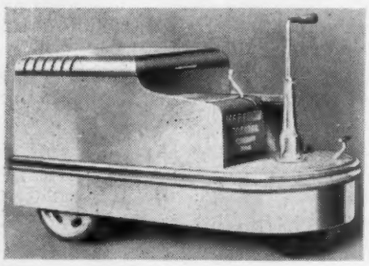
Zig-zag slot in adjustable foot portion of conveyor floor support pre-



vents slipping under heavy loads. Conventional type of floor support has plain vertical slot in foot portion with leg being adjusted in height by vertical movement and secured by nuts and bolts at desired position. New zig-zag slot will hold leg in position without necessity of drawing up nut extremely tight. Correct alignment for carrying surface of conveyor is maintained, insuring proper operation of equipment and simplified adjustment for height.

Single Wheel Steers Narrow Tread Tractor

■ Mercury Mfg. Co., 4044 South Halsted street, Chicago, has announced a new narrow tread, streamlined, electric tractor, 32 inches in overall width and rated at 500 pounds normal draw-bar pull and 1000 pounds maximum.

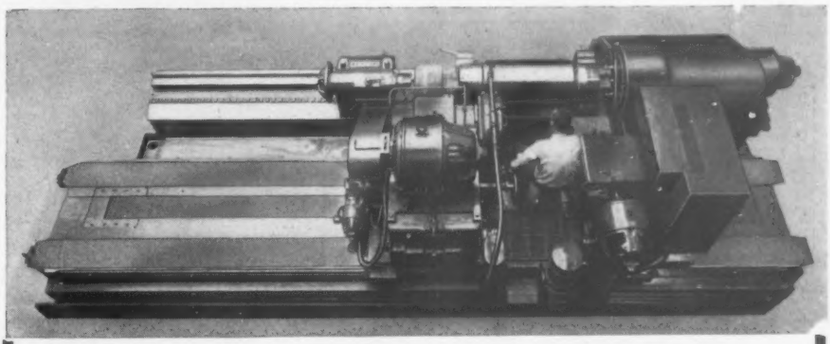


Frame of tractor is channel iron, shrouded and streamlined by welded steel plates into an integral unit, including battery compartment and operator's seat. A heavy rubber bumper is provided extending around entire exterior of machine. Tractor is available with stainless steel body and chromium plated exposed running gear for special institutional service. Enamel finish is standard.

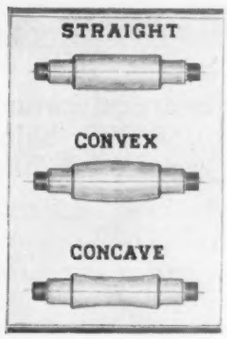
Drive axle is of worm reduction type with transverse semi-elliptic spring suspension. Drive tires are size 20 x 3½ inches. Steering is single wheel type with 15 x 3½ inches rubber tired wheel. Drum type controller provides three travel speeds forward and three reverse.

Announces Changes in Flexible Coupling Line

■ Charles Bond Co., 617 Arch street, Philadelphia, announces changes in five intermediate sizes of the BONDTRU flexible insulated coupling, resulting in greater horsepower



FARREL HEAVY DUTY ROLL GRINDERS



Grind Straight, Convex or Concave Contours to Exact Symmetry and Accuracy

The quality of surface and accuracy of gauge of rolled metal strip and sheet depends upon the finish and accuracy of the rolls through which it is passed.

Farrel Heavy Duty Roll Grinders grind rolls of any material with extreme precision and with any desired finish which can be obtained with wheels at present available. They are equally capable of heavy roughing or fine finishing and produce a perfect surface free from marks of any kind. Straight, convex or concave contours are ground to exact symmetry and accuracy.

Automatic and semi-automatic features reduce dependence upon the skill of the operator to a minimum, removing the shaping and finishing of rolls from the class of craftsmanship and enabling the plant management to control roll accuracy and finish in accordance with predetermined standards.

For full information send for Bulletin No. 111

FARREL

FARREL-BIRMINGHAM COMPANY, Inc.
ANSONIA, CONN.
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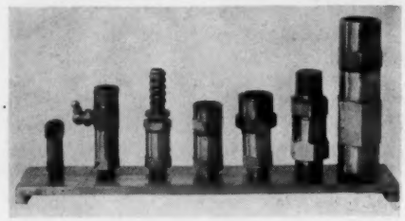
ratings and larger maximum bores.

These couplings have been redesigned to use inserts with six radiating arms, providing three driving points of contact instead of the former 4-arm insert which provided only two driving points of contact. Flange hubs have also been enlarged to permit boring for larger shaft sizes.

A ¼-horsepower size coupling in 38 different lengths, ranging from the standard 1 9/16 to 5 11/16 inches, has been added. These are made up of combinations of various length flanges, longer couplings having one or two Bakelite extension members added. Flexible inserts of special oil-proof rubber and cork composition, or leather, separate each metallic or Bakelite member from adjoining member and adds to flexibility of coupling.

Swivel Coupling Joints Bear On Ground Surfaces

■ Oseka Bros., 3 East avenue, Elyria, O., announce a line of Giberson packless swivel couplings in sizes from ⅛ to 1½ inches. For air or liquid lines, this type of swivel does not use compressible packing. Joints bear on ground surfaces and will swivel satisfactorily at pressures of over 4000 pounds per square inch. When assembled, swivels are



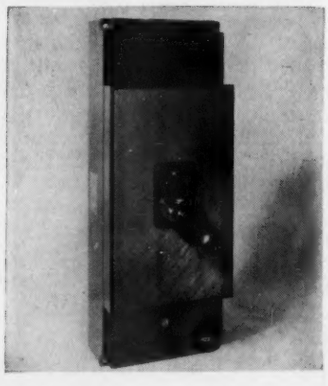
filled with a heat-resisting grease which will withstand 370 degrees Fahr., before melting. Swivels are furnished with brass body and steel top, or all-steel.

The straight hose swivels have been approved by safety inspectors who consider them as safety devices as well as a means of eliminating kinks and twists in the hose. Swivel couplings for air tools can be furnished with alemite grease cup to permit greasing tool without shutting off air or disconnecting hose from tool.

Circuit Breakers Have Silver Alloy Contacts

■ Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has announced an air circuit breaker of 20,000-ampere interrupting capacity, designed for circuit protection of main distribution feeders in central stations, industrial plants or building equipment.

They are available in wire size ratings of from 70 to 600 amperes and for voltages up to and including 600 volts on alternating current or 250 volts on direct current. It is



claimed newly developed silver-alloy contacts assure positive contact and provide maximum protection against welding on heavy short circuits. Circuit breakers have instantaneous magnetic-trips which operate at from 9 to 10 times thermal rating. Composition is used for breaker housings. Ribs between poles permit minimum spacing and smallest overall dimensions.

Obsolete methods!

BOOST COSTS

Bigger sales and greater profits are the result of smart management and new and improved machinery and equipment. It is expensive economy to "make the old machine do".

STEARNS improved, better designed and better built electro-magnetic equipment will definitely help you get economical, smooth, trouble free production.

Use STEARNS magnetic clutches and brakes for efficient transmission control; STEARNS magnetic separators for a purer product and protection of processing machinery.

One of the many new and improved types of Stearns Magnetic Separators available for purifying various types of materials. More efficient, more economical.

Investigate STEARNS magnetic equipment now!

STEARNS

MAGNETIC MFG. CO.

SEPARATORS CLUTCHES
DRUMS BRAKES
ROLLS MAGNETS

BETTER MACHINES
FOR BETTER SEPARATION

650 SO. 28 ST. MILWAUKEE, WIS.

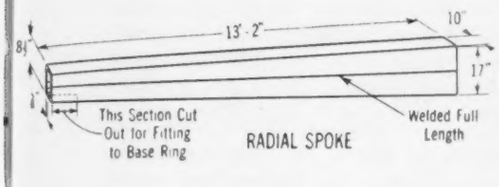
Large Pot Chuck

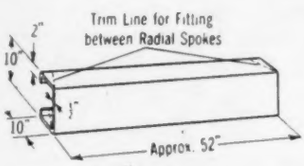
(*Concluded from Page* 65)

ner ring were welded together in the final assembly. Entire central hub section is 5 feet in diameter, while its inner ring is 30 inches inside diameter, 30 inches wide. It was made by flame cutting and bending a steel plate 2½ inches thick.

The welded steel pot chuck weighs 96,200 pounds, about 8800 pounds less than its estimated weight in cast iron. The weight could have been decreased still further if the rigidity characteristics of the cast iron design were only equaled. However, it was found economical in steel construction to effect not only a medium weight reduction but also to obtain increased rigidity.

Internal gears cut on this pot chuck are made in six segments, positioned in the chuck on an internal ring shelf which is welded





SPACER

Design of box section spoke and spacer used in the welded steel pot chuck

top and bottom to the inside surface of the main web and rigidly supported by 48 auxiliary ribs, closely spaced. These ribs are matched on outside of main web by an equal number of ribs running full depth of main web, all ¾-inch thick.

Main outer ring was formed of segments flame cut and bent. These pieces were 14½ x 2 inches for the top ring and 26 x 2 inches for bottom ring. When fitted together, these eight segments formed two rings, 33 feet 7 inches outside diameter. Main ring web of 2½-inch thick plate was bent to 31 feet 2 inches outside diameter.

All steel plate entering into the construction of the pot chuck was of special welding quality furnished by Lukens Steel Co.

For shipment, the two half sections of the pot chuck, each measuring 16 feet 10¼ inches high, were loaded on a well-type flat car and blocked in place. Halves had only 3-inch clearance from the rail, instead of the usual 6 inches. Clearance under certain overhead structures was only 1 inch. Train speed was limited to 20 miles per hour, and instructions given to handle the car with extreme care.

After arrival at Camden Forge Co., assembly and welding was completed in 12 working days.

Using the same special furnace designed and built for the heating operations on the internal gear forgings themselves, Camden Forge Co. stress relieved the finished pot chuck in one piece. Then top edge of main ring and inside surface down to and including top surface of inner shelf was machined to close limits. Outside diameter of top and bottom ring flanges and their top surfaces also were machined.

Pot chuck and slotter will be placed on a floating foundation to insulate them entirely from all outside vibration. Entire assembly will weigh approximately 1,000,000 pounds.

Each internal gear to be slotted will be in six segments and will be set up on the internal shelf of the pot chuck and bolted in place. The chuck will be rotated on rollers and the indexing accomplished through microscopes mounted on the slotter.

HOW TO REDUCE YOUR WELDING COSTS
From coast to coast, in plants fabricating welded structures of every description, Murex electrodes are helping to reduce welding costs. The reasons why are many. In one plant high burn-off rate may prove an advantage. In another, rapid deposition, or lack of spatter and smoothness of deposit may do the trick.
There is little question but what, in your plant, too, these Murex features can effect real economies. Why not write today and ask to have a representative demonstrate Murex. No obligation is involved. And, if you have a problem or two concerning welding procedure, his broad experience may prove extremely useful.
1 In marine work, vertical and overhead welding goes easily and quickly with Murex Vertex (reverse polarity) or Genex (straight polarity). Photo courtesy Ira S. Bushey & Sons Co., Inc., Brooklyn, N. Y.
We've a pocket-size pamphlet giving properties of all electrodes in the Murex line. Send for your copy.
2 Only 2700 lbs. of Murex welded this 40,000 lbs. jacketed still. Photo courtesy John Nooter Boiler Works Co., St. Louis, Mo.
3 High speed deposition saves time and money on the Lorain 79 Shovel. Photo courtesy The Thew Shovel Company, Lorain, Ohio.
4 Free-flowing Murex downhand electrodes speeded welding on this 96,200 lb. pot chuck, 33 ft. 7 in. in diameter, believed to be world's largest. Photo courtesy Lukenweld, Inc., Coatesville, Pa.
5 Economy of welding machinery such as this sluice gate hoist is increased by time-saving Murex Electrodes. Photo courtesy Lakeside Bridge & Steel Co., Milwaukee, Wis.
MUREX
HEAVY COATED
ELECTRODES
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Electric Motor Cores

(*Concluded from Page 63*)

truck skids have a welded angle iron framework in which two rows of stacks are carried. In Fig. 3 the operator is just beginning to form a stack in the first position along one side of this carrier.

As will be seen in Fig. 2 the motors driving the belt conveyors and stacking disk mechanism are connected directly to the press through flexible cables so they all start automatically as soon as the press motor is energized since they are all on on the same electric circuit. Thus the entire equipment starts simultaneously as soon as the operator feeding the press places the press in operation.

Producing almost 26,000 laminations per hour, the completely automatic conveyor mechanism described is most essential to obtain maximum output on the cookie press. There are two of these complete layouts at this plant that is, two cookie presses, each with complete conveyor and stacking equipment as described. Cookie disks produced by these presses now go either to an automatic press setup for punching rotor and stator slots or to conventional notching presses where the coil slots are punched slot by slot in each piece individually.

Also in this same room are a number of other stamping and forming presses used to make such items as feet for the motors, mounting brackets and similar parts. This equipment includes a 600-ton blanking press and three forming presses rated 800, 500 and 250 tons respectively. In addition there are a number of other smaller presses.

Typical work handled by these presses is production of heavy feet. Steel stock 7/32-inch in thickness is blanked and then goes through three forming operations and two piercing operations to make a completed motor foot. The maximum thickness which can be handled is ¼-inch. In addition to the blanking and forming presses mentioned, a 50-ton piercing press is used for the piercing operation. These heavy motor feet are produced at a rate of 500 to 600 per hour. They are handled through the plant in large skid boxes as shown in Fig. 5. This view also shows a number of the large presses employed in this work.

(Part II will appear next week)

Light Alloys Reduce Car's Weight One-Third

■ Extruded aluminum shapes joined with the new "squeeze rivets" make possible one-third saving in weight in a new rapid transit car, recently put into service on the Brooklyn-Manhattan transit system in New York.

Rubber-sprung and equipped with safety glass windows and plate glass interior mirrors, the car was built by Clark Equipment Co., Buchanan, Mich., which developed the rivets.

Rivets consist of a soft steel sleeve banded about a harder shaft; the soft steel is squeezed into place, forming a strong bond without heating or hammering and permitting rapid assembly when the work can be approached from only one side.

Eastern Founders Discuss Problems

(*Concluded from Page 20*)

were correct. "It generally is necessary either to standardize molding sand properties and vary the gating arrangement, or standardize the gating and vary the molding sand properties for best results."

Normal L. Mochel, Westinghouse Electric & Mfg. Co., Philadelphia, discussing castings from the consumer's viewpoint, urged close relationship between producer and buyer. Each, he said, must first realize that the other must make a profit and then analyze their mutual problems in advance and keep in close touch during production.

Visualizing an "ideal" consumer for purposes of discussion, Mr. Mochel said the buyer expects a casting salesman to know his product and is appreciative of visits of a high-grade contact man, an executive preferably. The consumer, where possible, should have a foundry expert on his staff. The consumer should promptly report back every defect, with a sketch.

While admitting the idea was controversial, Mr. Mochel believed the consumer should do welding necessary in assembly of his product in his own shop, with the foundry sending the castings ready for welding. With the aid of lantern slides, he discussed work in his own shop, particularly with respect to welding and use of fabricated steel. He thought that tests by gamma rays and x-rays were most useful, but "only as servants, not masters."

Use of fabricated metal is growing at the expense of castings, according to J. C. Pendleton, Newport News Shipbuilding & Dry Dock Co., Newport News, Va., giving as his opinion that the No. 1 problem is to regain this lost ground. In some lines inroads have been checked but he believed the general result still is adverse. Closer study of design, in co-operation with the consumer, is needed, he said. By lantern slides he illustrated various operations, particularly in marine castings and pressure work, for which he recommended virgin metal in all cases. He thought the importance of radiography often over-emphasized by customers though he appreciated the importance of such tests under various circumstances.

John Howe Hall, consulting engineer, Philadelphia, presided at the morning technical session and Sam Tour, Lucius Pitkin Inc., New York, at the afternoon session.

Demand Slumps As Sentiment Wavers

Steelmaking Continues To Dip; Structural Outlook Good

MARKET IN TABLOID ★

Demand
Quieter for most products.

Prices
Steady and unchanged.

Production
Off 1 point to 53½ per cent

■ SENTIMENT has been impaired by recent business and international developments, with a quieting effect on steel markets.

The letdown in steel demand so far has been less than would be suggested by softening in security prices and by pessimism attributed to uncertainty over the European outlook. Nevertheless, the past week's trend was more definitely downward and, coming on the heels of a disappointing March, provides little expectation of an immediate about-face in orders and production. Steelmaking the past week was off 1 point to 53½ per cent, compared with 32 per cent a year ago.

Reports of a lagging retail market for automobiles lacked confirmation in assemblies last week, production increasing about 1000 units to 87,019. While General Motors' output declined slightly to 32,735, Ford was steady at 22,230, Chrysler increased a trifle to 20,525 and all other makers boosted their total from 10,115 to 11,529.

At the same time, curtailment in releases of parts reflects the downward revision in previous estimates of near-future operations. Handicapped by three fewer working days, April appears likely to show a falling off in motorcar assemblies compared with March, contrary to the common seasonal trend.

Indication that not all interests will curtail production developed Friday with word that Dodge has increased April schedules by 9800 units and will release parts and materials accordingly. This may be the forerunner of a more general upswing within the next few weeks.

Activity In Structurals, Concrete Bars Sustained

Brightest spot in steel demand is sustained activity in structural shapes and concrete reinforcing bars. A large tonnage required for public works remains to be shipped, assuring a maintenance of production through this quarter. Outstanding in prospective engineering projects is the 100,000-ton, Battery Park-Brooklyn bridge at New York. Armament and private shipbuilding work also promise maintained consumption of heavy products.

Caution among consumers is evident in the letdown in new business, but since buying for some time has been for only early needs, users will be unable to remain out of the market for an extended period. The East, most susceptible to European and stock market influences, shows the largest shrinkage in steel bookings, while the more westerly districts are inclined to emphasize domestic conditions as responsible for the less favorable situation.

Railroad orders for equipment and steel products continue restricted. Several thousand tons of rails were booked the past week, and a few additional roads are expected in the market later, but freight car orders are materializing slower than was hoped for.

Freight Car Awards Lag But Well Ahead of 1938

Freight car awards the first three months this year totaled 3062, compared with 814 a year ago, 30,933 two years ago and 9582 the first quarter of 1936. Merchants Dispatch Inc. will build 200 seventy-ton cement cars in its own shops.

Steel ingot production in March was the largest since last November and 67.5 per cent ahead of a year ago. First quarter output of 9,506,594 tons was not quite half-way between the 5,448,896 tons of the 1938 period and the 14,351,451 tons produced the corresponding months of 1937. Reflecting the increases in steelmaking capacity the past ten years, March operations of 55.63 per cent represented 65 per cent of 1929 capacity.

Smaller districts were responsible for most of last week's shrinkage in ingot output. Pittsburgh was unchanged at 49 per cent and Chicago held at 53½. Operations also were steady at 40 per cent in eastern Pennsylvania, 66 at Wheeling, 52½ at Cleveland and 62 at Birmingham. Buffalo increased 2½ points to 44½.

Reductions included 15 points to 35 per cent in New England, 7 points to 44 per cent at Cincinnati, 5 points to 69 at Detroit, 2 points to 48 at Youngstown and 1 point to 42 at St. Louis.

An easier tone prevails in nearly all scrap markets, but prices are nominally unchanged in principal centers and the scrap composite holds at $15.04. The finished steel composite also is unchanged at $56.50.

COMPOSITE MARKET AVERAGES

	Apr. 8	Apr. 1	Mar. 25	One Month Ago Mar., 1939	Three Months Ago Jan., 1939	One Year Ago Apr., 1938	Five Years Ago Apr., 1934
Iron and Steel	$36.40	$36.42	$36.42	$36.40	$36.36	$38.61	$32.67
Finished Steel	56.50	56.50	56.50	56.50	56.50	61.70	53.90
Steelworks Scrap..	15.04	15.04	15.04	14.98	14.77	12.30	12.15

Iron and Steel Composite:—Pig iron, scrap, billets, sheet bars, wire rods, tin plate, wire, sheets, plates, shapes, bars, black pipe, rails, alloy steel, hot strip, and cast iron pipe at representative centers. Finished Steel Composite:—Plates, shapes, bars, hot strip, nails, tin plate, pipe. Steelworks Scrap Composite:—Heavy melting steel and compressed sheets.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	April 8, 1939	March 1939	Jan. 1939	April 1938
Steel bars, Pittsburgh	2.25c	2.25c	2.25c	2.45c
Steel bars, Chicago	2.25	2.25	2.25	2.50
Steel bars, Philadelphia	2.57	2.57	2.57	2.765
Iron bars, Terre Haute, Ind.	2.15	2.15	2.15	2.35
Shapes, Pittsburgh	2.10	2.10	2.10	2.25
Shapes, Philadelphia	2.215	2.215	2.215	2.465
Shapes, Chicago	2.10	2.10	2.10	2.30
Plates, Pittsburgh	2.10	2.10	2.10	2.25
Plates, Philadelphia	2.15	2.15	2.15	2.445
Plates, Chicago	2.10	2.10	2.10	2.30
Sheets, hot-rolled, Pittsburgh	2.15	2.15	2.15	2.40
Sheets, cold-rolled, Pittsburgh	3.20	3.20	3.20	3.45
Sheets, No. 24, galv., Pittsburgh	3.50	3.50	3.50	3.80
Sheets, hot-rolled, Gary	2.15	2.15	2.15	2.50
Sheets, cold-rolled, Gary	3.20	3.20	3.20	3.25
Sheets, No. 24, galv., Gary	3.50	3.50	3.50	3.90
Bright bess., basic wire, Pitts.	2.60	2.60	2.60	2.90
Tin plate, per base box, Pitts.	$5.00	$5.00	$5.00	$5.35
Wire nails, Pittsburgh	2.45	2.45	2.45	2.75

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$37.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	37.00
Rerolling billets, Pittsburgh	34.00	34.00	34.00	37.00
Wire rods, No. 5 to $\frac{9}{32}$-inch, Pitts.	43.00	43.00	43.00	47.00

Pig Iron

	April 8, 1939	March 1939	Jan. 1939	April 1938
Bessemer, del. Pittsburgh	$22.34	$22.34	$22.34	$25.30
Basic, Valley	20.50	20.50	20.50	23.50
Basic, eastern, del. Philadelphia	22.34	22.34	22.34	25.34
No. 2 foundry, Pittsburgh	22.21	22.21	22.21	25.21
No. 2 foundry, Chicago	21.00	21.00	21.00	24.00
Southern No. 2, Birmingham	17.38	17.38	17.38	20.38
Southern No. 2, del. Cincinnati	20.89	20.89	20.89	23.89
No. 2X, del. Phila. (differ. av.)	23.215	23.215	23.215	26.215
Malleable, Valley	21.00	21.00	21.00	24.00
Malleable, Chicago	21.00	21.00	21.00	24.00
Lake Sup., charcoal, del. Chicago	28.34	28.34	28.34	30.34
Gray forge, del. Pittsburgh	21.17	21.17	21.17	24.17
Ferromanganese, del. Pittsburgh	85.33	85.27	90.25	107.77

Scrap

Heavy melting steel, Pittsburgh	$15.75	$15.75	$15.60	$12.70
Heavy melt. steel, No. 2, E. Pa.	13.75	13.375	13.25	11.55
Heavy melting steel, Chicago	14.25	14.25	13.75	11.45
Rails for rolling, Chicago	17.25	17.25	17.75	15.25
Railroad steel specialties, Chicago	16.25	16.25	16.00	13.75

Coke

Connellsville, furnace, ovens	$ 3.75	$3.75	$3.75	$4.25
Connellsville, foundry, ovens	5.00	5.00	5.00	5.25
Chicago, by-product fdry., del.	10.50	10.50	10.50	11.00

STEEL, IRON, RAW MATERIAL, FUEL AND METALS PRICES

Except when otherwise designated, prices are base, f.o.b. cars.

Sheet Steel

Hot Rolled

Pittsburgh	2.15c
Chicago, Gary	2.15c
Cleveland	2.15c
Detroit, del.	2.25c
Buffalo	2.15c
Sparrows Point, Md.	2.15c
New York, del.	2.39c
Philadelphia, del.	2.32c
Granite City, Ill.	2.25c
Middletown, O.	2.15c
Youngstown, O.	2.15c
Birmingham	2.15c
Pacific Coast points	2.65c

Cold Rolled

Pittsburgh	3.20c
Chicago, Gary	3.20c
Buffalo	3.20c
Cleveland	3.20c
Detroit, delivered	3.30c
Philadelphia, del.	3.52c
New York, del.	3.54c
Granite City, Ill.	3.30c
Middletown, O.	3.20c
Youngstown, O.	3.20c
Pacific Coast points	3.80c

Galvanized No. 24

Pittsburgh	3.50c
Chicago, Gary	3.50c
Buffalo	3.50c
Sparrows Point, Md.	3.50c
Philadelphia, del.	3.67c
New York, delivered	3.74c
Birmingham	3.50c
Granite City, Ill.	3.60c
Middletown, O.	3.50c
Youngstown, O.	3.50c
Pacific Coast points	4.00c

Black Plate, No. 29 and Lighter

Pittsburgh	3.05c
Chicago, Gary	3.05c
Granite City, Ill.	3.15c

Long Ternes No. 24 Unassorted

Pittsburgh, Gary	3.95c
Pacific Coast	4.65c

Enameling Sheets

	No. 10	No. 20
Pittsburgh	2.75c	3.35c
Chicago, Gary	2.75c	3.35c
Granite City, Ill.	2.85c	3.45c
Youngstown, O.	2.75c	3.35c
Cleveland	2.75c	3.35c
Middletown, O.	2.75c	3.35c
Pacific Coast	3.35c	3.95c

Corrosion and Heat-Resistant Alloys

Pittsburgh base, cents per lb.

Chrome-Nickel

	No. 302	No. 304
Bars	24.00	25.00
Plates	27.00	29.00
Sheets	34.00	36.00
Hot strip	21.50	23.50
Cold strip	28.00	30.00

Straight Chromes

	No. 410	No. 430	No. 442	No. 446
Bars	18.50	19.00	22.50	27.50
Plates	21.50	22.00	25.50	30.50
Sheets	26.50	29.00	32.50	36.50
Hot strip	17.00	17.50	23.00	28.00
Cold stp.	22.00	22.50	28.50	36.50

Steel Plate

Pittsburgh	2.10c
New York, del.	2.29c
Philadelphia, del.	2.15c
Boston, delivered	2.42c
Buffalo, delivered	2.33c
Chicago or Gary	2.10c
Cleveland	2.10c
Birmingham	2.10c
Coatesville, base	2.10c
Sparrows Point, base	2.10c
Claymont, del.	2.10c
Youngstown	2.10c
Gulf ports	2.45c
Pacific Coast points	2.60c

Steel Floor Plates

Chicago	3.35c
Gulf ports	3.70c
Pacific Coast ports	3.95c
Pittsburgh	3.35c

Standard Shapes

Pittsburgh	2.10c
Philadelphia, del.	2.21¼c
New York, del.	2.27c
Boston, delivered	2.41c
Bethlehem	2.10c
Chicago	2.10c
Cleveland, del.	2.30c
Buffalo	2.10c
Gulf ports	2.45c
Birmingham	2.10c
St. Louis, del.	2.34c
Pacific Coast points	2.70c

Tin and Terne Plate

Tin Plate, Coke (base box)

Pittsburgh, Gary, Chicago	$5.00
Granite City, Ill.	5.10

Mfg. Terne Plate (base box)

Pittsburgh, Gary, Chicago	$4.30
Granite City, Ill.	4.40

Bars

Soft Steel

(Base, 3 to 25 tons)

Pittsburgh	2.25c
Chicago or Gary	2.25c
Duluth	2.35c
Birmingham	2.25c
Cleveland	2.25c
Buffalo	2.25c
Detroit, delivered	2.35c
Philadelphia, del.	2.57c
Boston, delivered	2.62c
New York, del.	2.59c
Gulf ports	2.60c
Pacific Coast points	2.85c

Rail Steel

To Manufacturing Trade

Pittsburgh	2.10c
Chicago or Gary	2.10c
Detroit, delivered	2.20c
Cleveland	2.10c

Buffalo	2.10c
Birmingham	2.10c
Gulf ports	2.45c
Pacific coast points	2.70c

Iron

Chicago, Terre Haute	2.15c
Philadelphia	2.47c
Pittsburgh, refined	3.50-8.00c

Reinforcing

New billet, straight lengths, quoted by distributors

Chicago, Gary, Buffalo Cleve., Birm., Young., Sparrows Pt., Pitts.	2.05c
Detroit, delivered	2.15c
Gulf ports	2.40c
Pacific coast ports	2.50c
Philadelphia, del.	2.22c

Rail steel, straight lengths, quoted by distributors

Pittsburgh, Gary, Chicago, Buffalo, Cleveland, Birmingham	1.90c
Detroit, delivered	2.00c
Gulf ports	2.25c
Pacific Coast	2.35c

Wire Products

Pitts.-Cleve.-Chicago-Birm. base per 100 lb. keg in carloads

Standard wire nails	$2.45
Cement coated nails	$2.45

(Per pound)

Polished staples	3.15c
Galv. fence staples	3.40c
Galv. barbed wire, standard 12½ gage two-point hog, 80-rod spool $2.80; two-point cattle, 80-rod spool	$2.62
Annealed fence wire	2.95c
Galv. fence wire	3.35c
Woven wire fencing (base C. L. column)	67.00
Single loop bale ties, (base C. L. column)	56.00

To Manufacturing Trade

Base, Pitts. - Cleve. - Chicago-Birmingham (except spring wire)

Bright bess., basic wire	2.60c
Galvanized wire	2.65c
Spring wire	3.20c

Worcester, Mass., $2 higher on bright basic and spring wire.

Cut nails, C. L. Pitts. (10% disc. on all extras)	$3.60

Cold-Finished Bars

	Carbon	Alloy
Pittsburgh	2.70c	3.40c
Chicago	2.70c	3.40c
Gary, Ind.	2.70c	3.40c
Detroit	2.75c	*3.50c
Cleveland	2.70c	3.40c
Buffalo	2.70c	3.40c

*Delivered.

Alloy Bars (Hot)

(*Base, 3 to 25 tons*)

Pittsburgh, Buffalo, Chicago, Massillon, Canton, Bethlehem	2.80c
Detroit, delivered	2.90c

S.A.E.	Alloy Diff.	S.A.E.	Alloy Diff.
2000	0.35	3100	0.70
2100	0.75	3200	1.35
2300	1.55	3300	3.80
2500	2.25	3400	3.20

4100 0.15 to 0.25 Mo.	0.55
4600 0.20 to 0.30 Mo. 1.50-2.00 Ni.	1.10
5100 0.80-1.10 Cr.	0.45
5100 Cr. spring flats	0.15
6100 bars	1.20
6100 spring flats	0.85
Cr. N., Van.	1.50
Carbon Van.	0.85
9200 spring flats	0.15
9200 spring rounds, squares	0.40

Electric furnace up 50 cents.

Piling

Pitts., Chgo., Buffalo	2.40c
Gulf ports	2.75c

Strip and Hoops

(*Base, hot-rolled, 1 to 25 tons; cold-rolled, 3 to 25 tons*)

Hot Strip, 12-inch and less

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, Birmingham	2.15c
Detroit, del.	2.25c
Philadelphia, del.	2.47c
New York, del.	2.51c
Cooperage hoop, Youngs., Pitts., Chicago, Birm.	2.25c
Cold strip, 0.25 carbon and under, Pittsburgh, Cleveland, Youngstown	2.95c
Chicago	3.05c
Detroit, del.	3.05c
Worcester, Mass.	3.15c

Carbon	Cleve. Pitts.
0.26—0.50	2.95c
0.51—0.75	4.30c
0.76—1.00	6.15c
Over 1.00	8.35c

Worcester, Mass $4 higher.

Commodity Cold-Rolled Strip

Pitts.-Cleve.-Youngstown	3.10c
Detroit, del.	3.20c
Worcester, Mass.	3.50c

Lamp stock up 10 cents.

Rails, Fastenings

(*Gross Tons*)

Standard rails, mill	$40.00
Relay rails, Pittsburgh 20—100 lbs.	32.50-35.50
Light rails, billet qual., Pitts., Chicago, B'ham.	$40.00
Do., rerolling quality	39.00

Cents per pound

Angle bars, billet, mills	2.70c
Do., axle steel	2.35c
Spikes, R. R. base	3.00c
Track bolts, base	4.15c
Car axles forged, Pitts., Chicago, Birmingham	3.15c
Tie plates, base	2.15c

Base, light rails 25 to 60 lbs., 20 lbs., up $2; 16 lbs. up $4; 12 lbs. up $8; 8 lbs. up $10. Base railroad spikes 200 kegs or more; base plates 20 tons.

Bolts and Nuts

Pittsburgh, Cleveland, Birmingham, Chicago. Discounts to legitimate trade as per Dec. 1, 1932, lists, carloads 5% up; full containers additional 10%.

Carriage and Machine

½ x 6 and smaller	68.5 off
Do. larger, to 1-in.	66 off
Do. 1⅛ and larger	64 off
Tire bolts	52.5 off

Stove Bolts

In packages with nuts attached 72.5 off; in packages with nuts separate 72.5-12½ off; bulk 84 off on 15,000 of 3-inch and shorter, or 5000 over 3-in.

Step bolts	60 off
Elevator bolts	60 off
Plow bolts	68.5 off

Nuts

Semifinished hex.	U.S.S.	S.A.E.
6-inch and less	67	70
⅞-1-inch	64	65
1⅛ and larger	62	62

Hexagon Cap Screws

Upset, 1-in., smaller	67.5 off

Square Head Set Screws

Upset, 1-in., smaller	75.0 off
Headless set screws	70.0 off

Rivets, Washers

Structural, Pittsburgh, Cleveland, Chicago	3.40c
⅞-inch and smaller, Pitts., Chi., Cleve.	65-10 off
Wrought washers, Pitts., Chi., Phila., to jobbers	
and large nut, bolt mfrs. l.c.l. $5.40; c.l. $5.75 off	

Welded Iron, Steel Pipe

Base discounts on steel pipe. Pitts., Lorain, O., to consumers in carloads. Gary, Ind., 2 points less on lap weld, 1 point less on butt weld. Chicago delivery 2½ and 1½ less, respectively. Wrought pipe, Pittsburgh base.

Butt Weld

Steel

In.	Blk.	Galv.
⅛	63½	54
¼	66½	58
1—3	68½	60½

Iron

¼	30	13
1—1¼	34	19
1½	38	21½
2	37½	21

Lap Weld

Steel

2	61	52½
2½—3	64	55½
3½—6	66	57½
7 and 8	65	55½
9 and 10	64½	55
11 and 12	63½	54

Iron

2	30½	15
2½—3½	31½	17½
4	33½	21
4½—8	32½	20
9—12	28½	15

Line Pipe

Steel

1 to 3, butt weld	67½
2, lap weld	60
2½ to 3, lap weld	63
3½ to 6, lap weld	65
7 and 8, lap weld	64
10-inch lap weld	63½
12-inch, lap weld	62½

Iron

	Blk.	Galv.
¾ butt weld	25	7
1 and 1¼ butt weld	29	13
1½ butt weld	33	15½
2 butt weld	32½	15
1½ lap weld	23½	7
2 lap weld	25½	9
2½ to 3½ lap weld	26½	11½
4 lap weld	28½	15
4½ to 8 lap weld	27½	14
9 to 12 lap weld	23½	9

Boiler Tubes

Carloads minimum wall seamless steel boiler tubes, cut lengths 4 to 24 feet; f.o.b. Pittsburgh, base price per 100 feet subject to usual extras.

Lap Welded

Sizes	Gage	Steel	Charcoal Iron
1½" O. D.	13	$ 9.72	$23.71
1¾" O. D.	13	11.06	22.93
2" O. D.	13	12.38	19.35
2¼" O. D.	13	13.79	21.68
2¼" O. D.	12	15.16	.....
2½" O. D.	12	16.58	26.57
2¾" O. D.	12	17.54	29.00
3" O. D.	12	18.35	31.36
3½" O. D.	11	23.15	39.81
4" O. D.	10	28.66	49.90
5" O. D.	9	44.25	73.93
6" O. D.	7	68.14	.....

Seamless

Sizes	Gage	Hot Rolled	Cold Drawn
1" O. D.	13	$ 7.82	$ 9.01
1¼" O. D.	13	9.26	10.67
1½" O. D.	13	10.23	11.79
1¾" O. D.	13	11.64	13.42
2" O. D.	13	13.04	15.03
2¼" O. D.	13	14.54	16.76
2½" O. D.	12	16.01	18.45
2½" O. D.	12	17.54	20.21
2¾" O. D.	12	18.59	21.42
3" O. D.	12	19.50	22.48
3½" O. D.	11	24.62	28.37
4" O. D.	10	30.54	35.20
4½" O. D.	10	37.35	43.04
5" O. D.	9	46.87	54.01
6" O. D.	7	71.96	82.93

Cast Iron Pipe

Class B Pipe—Per Net Ton

6-in., & over, Birm.	$42.00-43.00
4-in., Birmingham	45.00-46.00
4-in., Chicago	53.80-54.80
6-in. & over, Chicago	50.80-51.80
6-in. & over, east fdy.	46.00
Do., 4-in.	49.00

Class A Pipe $3 over Class B
Stnd. fitgs., Birm., base $100.00

Semifinished Steel

Rerolling Billets, Slabs

(*Gross Tons*)

Pittsburgh, Chicago, Gary, Cleve., Buffalo, Young., Birm., Sparrows Point	$34.00
Duluth (billets)	36.00
Detroit, delivered	36.00

Forging Quality Billets

6 x 6 to 9 x 9-in., base

Pitts., Chicago, Buffalo	40.00
Duluth	42.00

Sheet Bars

Pitts., Cleveland, Young., Sparrows Point, Buffalo, Canton, Chicago	34.00
Detroit, delivered	36.00

Wire Rods

Pitts., Cleveland, Chicago, Birmingham No. 5 to ⅜-inch incl.	43.00
Do., over ⅜ to 41/64-in. incl.	48.00

Worcester up $2; Galveston up $6; Pacific Coast up $9.

Skelp

Pitts., Chi., Young., Buff., Coatesville, Sparrows Pt.	1.90c

Coke

Price Per Net Ton

Beehive Ovens

Connellsville, fur.	$3.75
Connellsville, fdry.	4.75- 5.50
Connell. prem. fdry.	5.75- 6.25
New River fdry.	6.50- 6.75
Wise county fdry.	5.50- 5.75
Wise county fur.	4.50- 4.75

By-Product Foundry

Newark, N. J., del.	10.88-11.35
Chi., ov., outside del.	9.75
Chicago, del.	10.50
Milwaukee, ovens	10.50
New England, del.	12.50
St. Louis, del.	11.00-11.50
Birmingham, ovens	7.00
Indianapolis, del.	10.00
Cincinnati, del.	9.75
Cleveland, del.	10.30
Buffalo, del.	10.50
Detroit, del.	10.25
Philadelphia, del.	10.65

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol	16.00c
Toluol, two degree	22.00c
Solvent naphtha	26.00c
Industrial xylol	26.00c

Per lb. f.o.b. Frankford and St. Louis

Phenol (200 lb. drums)	16.25c
Do. (450 lbs.)	15.25c

Eastern Plants, per lb.

Naphthalene flakes, balls, bbls. to jobbers	5.75c
Per ton, bulk, f.o.b. port	
Sulphate of ammonia	$28.00

Pig Iron

Delivered prices include switching charges only as noted. No. 2 foundry is 1.75-2.25 sil.; 25c diff. for each 0.25 sil. above 2.25 sil.; 50c diff. below 1.75 sil. Gross tons.

Basing Points:	No. 2 Fdry.	Malleable	Basic	Bessemer
Bethlehem, Pa.	$22.00	$22.50	$21.50	$23.00
Birdsboro, Pa.	22.00	22.50	21.50	23.00
Birmingham, Ala.‡	17.38	.....	16.38	22.00
Buffalo	21.00	21.50	20.00	22.00
Chicago	21.00	21.00	20.50	21.50
Cleveland	21.00	21.00	20.50	21.50
Detroit	21.00	21.00	20.50	21.50
Duluth	21.50	21.50	.....	22.00
Erie, Pa.	21.00	21.50	20.50	22.00
Everett, Mass.	22.00	22.50	21.50	23.00
Granite City, Ill.	21.00	21.00	20.50	21.50
Hamilton, O.	21.00	21.00	20.50	.....
Neville Island, Pa.	21.00	21.00	20.50	21.50
Provo, Utah	19.00	.....	.....	.....
Sharpsville, Pa.	21.00	21.00	20.50	21.50
Sparrow's Point, Md.	22.00	.....	21.50	.....
Swedeland, Pa.	22.00	22.50	21.50	23.00
Toledo, O.	21.00	21.00	20.50	21.50
Youngstown, O.	21.00	21.00	20.50	21.50

‡Subject to 38 cents deduction for 0.70 per cent phosphorus or higher.

Delivered from Basing Points:

Akron, O., from Cleveland	22.39	22.39	21.89	22.89
Baltimore from Birmingham	22.78	.....	21.66	.....
Boston from Birmingham	22.12	.....	.....	.....
Boston from Everett, Mass.	22.50	23.00	22.00	23.50
Boston from Buffalo	22.50	23.00	22.00	23.50
Brooklyn, N. Y., from Bethlehem	24.50	25.00	.....	.....
Canton, O., from Cleveland	22.39	22.39	21.89	22.89
Chicago from Birminghom	†21.22	.....	.....	.....
Cincinnati from Hamilton, O.	21.24	22.11	21.61	.....
Cincinnati from Birmingham	21.06	.....	20.06	.....
Cleveland from Birmingham	21.32	.....	20.82	.....
Mansfield, O., from Toledo, O.	22.94	22.94	22.44	22.44
Milwaukee from Chicago	22.10	22.10	21.60	22.60
Muskegon, Mich., from Chicago, Toledo or Detroit	24.19	24.19	23.69	24.69
Newark, N. J., from Birmingham	23.15	.....	.....	.....
Newark, N. J., from Bethlehem	23.53	24.03	.....	.....
Philadelphia from Birmingham	22.46	.....	21.96	.....
Philadelphia from Swedeland, Pa.	22.84	23.34	22.34	.....
Pittsburgh district from Neville Island	Neville base, plus 69c, 84c, and $1.24 freight.			
Saginaw, Mich., from Detroit	23.45	23.45	22.95	22.95
St. Louis, northern	21.50	21.50	21.00	.....
St. Louis from Birmingham	†21.12	.....	20.62	.....
St. Paul from Duluth	23.63	23.63	.....	24.13

†Over 0.70 phos.

Low Phos.

Basing Points: Birdsboro and Steelton, Pa., and Standish, N. Y., $26.50, base; $27.74 delivered Philadelphia.

Gray Forge		Charcoal	
Valley furnace	$20.50	Lake Superior fur.	$25.00
Pitts. dist. fur.	20.50	do., del Chicago	28.34
		Lyles, Tenn.	23.50

†Silvery

Jackson county, O., base: 6-6.50 per cent $25.50; 6.51-7—$26.00; 7-7.50—$26.50; 7.51-8—$27.00; 8-8.50—$27.50; 8.51-9—$28.00; 9-9.50—$28.50; Buffalo, $1.25 higher.

Bessemer Ferrosilicon†

Jackson county, O., base; Prices are the same as for silveries, plus $1 a ton.

†The lower all-rail delivered price from Jackson, O., or Buffalo is quoted with freight allowed.

Manganese differentials in silvery iron and ferrosilicon, 2 to 3%, $1 per ton add. Each unit over 3%, add $1 per ton.

Refractories

Per 1000 f.o.b. Works, Net Prices

Fire Clay Brick

Super Quality

Pa., Mo., Ky.	$60.80

First Quality

Pa., Ill., Md., Mo., Ky.	47.50
Alabama, Georgia	47.50
New Jersey	52.50

Second Quality

Pa., Ill., Ky., Md., Mo.	42.75
Georgia, Alabama	34.20
New Jersey	49.00

Ohio

First quality	39.90
Intermediate	36.10
Second quality	31.35

Malleable Bung Brick

All bases	$56.05

Silica Brick

Pennsylvania	$47.50
Joliet, E. Chicago	55.10
Birmingham, Ala.	47.50

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press	$28.00
Wire cut	$26.00

Magnesite

Imported dead - burned grains, net ton f.o.b. Chester, Pa., and Baltimore bases (bags)	$45.00
Do. domestic	40.00
Do., f.o.b. Chewelah, Wash., net ton, bulk	22.00
net ton, bags	26.00
Quickset magnesite grains, f.o.b. Chewelah, Wash., net ton, bulk	22.00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Chrome brick	$47.00
Chem. bonded chrome	47.00
Magnesite brick	67.00
Chem. bonded magnesite	57.00

Fluorspar, 85-5

Washed gravel, duty paid, tide, net ton	$22.00
Washed gravel, f.o.b. Ill., Ky., net ton, carloads, all rail $17, barge	$18.00
No. 2 lump	18.00

Ferroalloy Prices

Ferromanganese, 78-82%, tidewater, duty pd. $80.00
Do., del. Pittsburgh 85.33

Spiegeleisen, 19-21% dom. Palmerton, Pa., spot 28.00
Do., 26-28%, Palmerton 33.00

Ferrosilicon, 50% freight allowed, c.l. 69.50
Do., ton lot 80.50
Do., 75 per cent 126.00
Spot, $5 a ton higher.

Silicoman, 2½ carbon 88.00
2% carbon, 93.00; 1%, 103.00
Contract ton price $11 higher; spot $5 over contract.

Ferrotungsten, stand., lb. con. del. cars 1.65-1.70

Ferrovanadium, 35 to 40%, lb., cont. 2.70-2.80-2.90

Ferrophosphorus, gr. ton, c.l., 17-18% Rockdale, Tenn., basis, 18%, $3 unitage, 58.50; electrolytic, per ton, c. l., 23-26% f.o.b. Monsanto, Tenn., 24% $3 unitage 75.00

Ferrochrome, 66-70 chromium, 4-6 carbon, cts. lb., contained cr., del. carlots 10.50c
Do., ton lots 11.25c
Do., less-ton lots 11.50c

67-72% carloads, 2% carbon, per lb. contained chrome 16.50c
Do., ton lots 17.25c
Do., less-ton lots 17.75c

	Carloads	Ton lots	Less ton
2% carb.	16.50c	17.25c	17.50c
1% carb.	17.50c	18.25c	18.50c
0.10% carb.	18.50c	19.25c	19.50c
0.20% carb.	19.50c	20.25c	20.50c

Spot ¼c higher

Ferromolybdenum, 55-65% molyb. cont., f.o.b. mill, lb. 0.95

Calcium molybdate, lb. molyb. cont., f.o.b. mill 0.80

Ferrotitanium, 40-45%, lb., con. ti., f.o.b. Niagara Falls, ton lots $1.23
Do., less-ton lots 1.25
20-25% carbon, 0.10 max., ton lots, lb. 1.35
Do, less-ton lots 1.40
Spot 5c higher

Ferrocolumbium, 50-60%, contract, lb. con. col., f.o.b. Niagara Falls $2.25
Do, less-ton lots 2.30
Spot is 10c higher

Technical molybdenum trioxide, 53 to 60% molybdenum, lb. molyb. cont., f.o.b. mill 0.80

Ferro-carbon-titanium, 15-18%, ti., 6-8% carb., carlots, contr., net ton $142.50
Do, spot 145.00
Do, contract, ton lots 145.00
Do, spot, ton lots 150.00

15-18% ti., 3-5% carbon, carlots, contr., net ton 157.50
Do, spot 160.00
Do, contract, ton lots 160.00
Do, spot, ton lots 165.00

Alsifer, contract carlots, f.o.b. Niagara Falls, lb. 7.50c
Do, ton lots 8.00c
Do, less-ton lots 8.50c
Spot ½c lb. higher

Chromium Briquets, contract, any quantity, freight allowed, lb. 7.25c
Do, spot carlots, bulk 7.50c
Do, ton lots 8.00c
Do., less-ton lots 8.25c

Tungsten Metal Powder, according to grade, spot shipment, 200-lb. drum lots, lb. $2.05
Do, smaller lots 2.15

Vanadium Pentoxide, contract, lb. contained $1.10
Do, spot 1.15

Chromium Metal, 98% cr., 0.50 carbon max., contract, lb. con. chrome 80.00c
Do, spot 85.00c
88% chrome, contract 79.00c
Do, spot 84.00c

Silicon Metal, 1% iron, contract, carlots, 2 x ⅛-in., lb. 14.00c
Do, 2% 12.50c
Spot ¼c higher

Silicon Briquets, contract carloads freight allowed, ton $69.50
Carload, spot 74.50
Less-ton lots, lb. 3.75c

Manganese Briquets, contract carloads, bulk freight allowed, lb. 4.50c
Ton lots 5.00c
Less-ton lots 5.25c
Spot ¼c higher

Zirconium Alloy, 12-15%, contract, carloads, gross ton $97.50
Do, spot 102.50
34-40%, contract, carloads, lb., alloy 14.00c
Do, ton lots 15.00c
Do, less-ton lots 16.00c
Spot ¼c higher

Molybdenum Powder, 99%, f.o.b. York, Pa. 200-lb. kegs, lb. $2.60
Do, 100-200 lb. lots 2.75
Do, under 100-lb. lots 3.00

Molybdenum Oxide Briquets, 48-52% molybdenum, per pound contained, f.o.b. producers' plant 80.00c

WAREHOUSE STEEL PRICES

Base Prices in Cents Per Pound, Delivered Locally, Subject to Prevailing Differentials

	Soft Bars	Bands	Hoops	Plates ¼-in. & Over	Structural Shapes	Floor Plates	Sheets Hot Rolled	Sheets Cold Rolled	Sheets Galv. No. 24
Boston	3.98	4.21	5.21	3.85	3.85	5.66	3.86	4.93	4.61
New York (Metropolitan)	3.94	4.11	4.11	3.76	3.75	5.56	3.40	4.60	4.50
Philadelphia	3.60	3.60	4.10	3.40	3.40	5.00	3.40	....	4.33
Baltimore	3.80	3.95	4.35	3.65	3.65	5.00	3.70	5.05	4.30
Norfolk, Va.	4.00	4.15	....	3.85	3.85	5.20	3.90	....	5.40
Buffalo	3.60	3.97	3.97	3.77	3.55	5.40	3.50	4.55	4.40
Pittsburgh	3.60	3.75	3.75	3.55	3.55	5.15	3.50	4.60	4.50
Cleveland	3.50	3.65	3.65	3.55	3.73	5.33	3.50	4.70	4.62
Detroit	3.43	3.58	3.83	3.75	3.80	5.42	3.58	4.65	4.74
Cincinnati	3.85	3.82	3.82	3.80	3.83	5.43	3.57	....	4.57
Chicago	3.60	3.75	3.75	3.55	3.55	5.15	3.50	4.45	4.50
Minneapolis	3.85	4.00	4.00	3.80	3.80	5.40	3.75	5.10	4.75
Milwaukee	3.73	3.88	3.88	3.68	3.68	5.28	3.63	4.58	4.63
St. Louis	3.72	3.87	3.87	3.47	3.47	5.07	3.53	4.47	4.53
Kansas City	4.15	4.30	4.30	4.10	4.10	5.70	4.10	....	4.75
Memphis	4.00	4.15	4.15	3.95	3.95	5.71	3.90	....	5.25
Chattanooga	3.90	4.05	4.05	3.85	3.85	5.80	3.80	....	4.40
Tulsa, Okla.	4.64	4.79	4.79	4.59	4.59	6.19	4.54	....	5.54
Birmingham, Ala.	3.50	3.65	3.65	3.45	3.45	5.83	3.40	....	4.75
New Orleans	3.85	4.65	4.65	3.80	3.80	5.75	4.10	....	4.60
Houston, Tex.	3.50	5.85	6.25	4.05	4.05	5.65	3.95	....	5.25
Seattle	4.30	4.50	5.85	4.05	4.15	5.90	3.95	....	5.25
Portland, Oreg.	4.00	4.40	6.10	4.00	4.00	5.50	3.95	6.50	4.75
Los Angeles	4.00	4.50	6.35	4.00	4.00	6.20	4.20	6.30	4.75
San Francisco	3.65	4.05	6.00	3.60	3.60	5.20	3.60	6.40	5.15

	Cold Rolled Strip	Cold Finished Bars	SAE Hot-rolled Bars (Unannealed) 1035-1050	2300 Series	3100 Series	4100 Series	6100 Series	SAE Cold Drawn Bars 2300	3100
Boston	3.61	4.18	4.28	7.65	6.25	6.00	8.05	8.73	7.33
New York	3.66	4.14	4.14	7.50	6.10	5.85	....	8.69	7.29
Philadelphia	3.66	4.11	3.85	7.46	6.06	5.81	8.71	....	....
Baltimore	....	4.10	3.95	....	....	....	....	....	....
Norfolk, Va.	....	4.20	....	....	....	....	....	....	....
Buffalo	3.57	3.80	3.80	7.25	5.85	5.60	7.65	8.25	6.85
Pittsburgh	3.35	3.70	3.80	7.35	5.95	5.70	7.75	8.35	6.95
Cleveland	3.35	3.80	3.70	7.45	6.05	6.05	7.85	8.25	6.85
Detroit	3.55	3.85	3.58	7.57	6.17	5.92	7.39	8.55	7.15
Cincinnati	3.60	4.05	3.90	7.59	6.19	5.94	8.99	8.60	7.20
Chicago	3.65	3.80	3.80	7.25	5.85	5.60	7.65	8.25	6.85
Minneapolis	....	4.39	4.00	7.60	6.20	8.79	9.34	8.94	7.54
Milwaukee	....	3.93	3.93	7.48	6.08	5.83	7.88	8.48	7.08
St. Louis	3.76	4.07	3.92	7.62	6.22	5.97	8.02	8.62	7.22
Kansas City	4.46	4.60	....	....	....	....	....	....	....
Memphis	....	4.61	....	....	....	....	....	....	....
Chattanooga	....	4.44	....	....	....	....	....	....	....
Tulsa, Okla	....	4.84	....	....	....	....	....	....	....
Birmingham, Ala.	....	4.73	....	....	....	....	....	....	....
New Orleans	5.00	5.10	....	....	....	....	....	....	....
Seattle	....	5.60	5.65	....	7.80	7.65	8.45	....	....
Portland, Oreg.	....	5.60	6.10	9.00	8.00	7.85	8.70	....	....
Los Angeles	4.45	6.00	4.65	9.40	8.55	8.40	9.05	10.40	9.55
San Francisco	*9.30	6.55	5.20	9.65	8.80	8.65	9.30	10.65	9.80

* Based on minimum quantity.

CURRENT IRON AND STEEL PRICES OF EUROPE

Dollars at Rates of Exchange, April 6

Export Prices f. o. b. Port of Dispatch—

By Cable or Radio

	British gross tons U. K. ports £ s d	Quoted in dollars at current value	Continental Channe or North Sea ports, gross tons **Quoted in gold pounds sterling £ s d
Foundry, 2.50-3.00 Si.	$23.45 5 0 0	$17.25	2 0 6
Basic bessemer	....	16.40	1 18 6
Hematite, Phos. .03-.05	26.97 5 15 0*	.....	.....
Billets	$34.59 7 7 6	$38.34	4 10 0
Wire rods, No. 5 gage	53.35 11 7 6	42.60	5 0 0
Standard rails	$44.56 9 10 0	$48.99	5 15 0
Merchant bars	2.30c 11 0 0	1.85c to 1.95c	4 15 0 to 5 0 0
Structural shapes	2.09c 10 0 0	1.85c to 1.90c	4 15 0 to 4 17 6
Plates, †¼ in. or 5 mm.	2.29c 10 18 9	2.10c to 2.34c	5 7 6 to 6 0 0
Sheets, black, 24 gage or 0.5 mm.	2.72c 13 0 0	2.93c	7 10 0*
Sheets, gal., 24 ga., corr.	3.29c 15 15 0	3.61c	9 5 0
Bands and strips	2.77c 13 5 0	1.95c	5 0 0
Plain wire, base	4.08c 19 10 0	2.39c to 2.83c	6 2 6 to 7 5 0
Galvanized wire, base	4.86c 23 5 0	3.07c to 3.17c	7 17 6 to 8 2 6
Wire nails, base	.....	2.73c to 2.93c	7 0 0 to 7 10 0
Tin plate, box 108 lbs.	$ 4.73 1 0 3	.....	.....

British ferromanganese $80.00 delivered Atlantic seaboard duty-paid.

Domestic Prices at Works or Furnace—

Last Reported

	£ s d		French Francs		Belgian Francs		Reich Mark
Fdy. pig iron, Si. 2.5	$23.22	4 19 0(a)	$17.44	620.50	$15.17	450	$25.28 63
Basic bess. pig iron	21.69	4 12 6(a)	.....	...	.....	...	27.88(b) 69.50
Furnace coke	5.39	1 4 2	5.96	225	7.25	215	7.62 19
Billets	34.59	7 7 6	25.04	945	28.98	860	38.72 96.50
Standard rails	1.99c	9 10 0	1.56c	1,300	2.06c	1,375	2.38c 132
Merchant bars	2.42c	11 12 0††	1.44c	1,202	1.65c	1,100	1.98c 110
Structural shapes	2.17c	10 8 0††	1.41c	1,173	1.65c	1,100	1.93c 107
Plates, †¼-in. or 5 mm	2.29c	10 19 3††	1.82c	1,515	2.06c	1,375	2.29c 127
Sheets, black	3.08c	14 15 0§	2.17c	1,805‡	2.36c	1,575‡	2.59c 144‡
Sheets, galv., corr., 24 ga. or 0.5 mm.	3.61c	17 5 0	3.30c	2,750	4.13c	2,750	6.66c 370
Plain wire	4.08c	19 10 0	1.92c	1,600	2.48c	1,650	3.11c 173
Bands and strips	2.58c	12 7 0††	1.71c	1,340	1.95c	1,300	2.29c 127

*Basic. †British ship-plates. Continental, bridge plates. §24 ga. ‡1 to 3 mm. basic price. British quotations are for basic open-hearth steel. Continent usually for basic-bessemer steel. (a) del. Middlesbrough. 5s rebate to approved customers. (b) hematite. °Close annealed. ††Rebate of 15s on certain conditions.

**Gold pound sterling carries a premium of 75 per cent over paper sterling.

IRON AND STEEL SCRAP PRICES

Corrected to Friday night. Gross tons delivered to consumers, except where otherwise stated; †indicates brokers prices

HEAVY MELTING STEEL

Birmingham, No. 1.	†12.00
Bos. dock No. 1 exp.	13.75-14.00
New Eng. del. No. 1	14.00
Buffalo, No. 1	13.75-14.25
Buffalo, No. 2	12.00-12.50
Chicago, No. 1	14.00-14.50
Chicago, auto, no alloy	12.50-13.00
Chicago, No. 2 auto	11.50-12.00
Cincinnati, dealers	11.50-12.00
Cleveland, No. 1	14.50-15.00
Cleveland, No. 2	13.50-14.00
Detroit, No. 1	10.50-11.00
Detroit, No. 2	9.00- 9.50
Detroit (industrial)	11.00-11.50
Eastern Pa., No. 1	15.50-16.00
Eastern Pa., No. 2	13.50-14.00
Federal, Ill.	11.75-12.25
Granite City, R. R.	12.00-12.50
Granite City, No. 2	11.00-11.50
Los Angeles, No. 1	12.50-13.50
Los Angeles, No. 2	11.00-11.50
N. Y. dock No. 1 exp.	12.00-12.50
Pitts., No. 1 (R. R.)	16.25-16.75
Pittsburgh, No. 1	15.50-16.00
Pittsburgh, No. 2	14.50-15.00
St. Louis, R. R.	12.25-12.75
St. Louis, No. 2	11.00-11.50
San Francisco, No. 1	12.00
Seattle, No. 1	12.00
Toronto, dlrs. No. 1.	9.50- 9.75
Valleys, No. 1	15.00-15.50

COMPRESSED SHEETS

Buffalo	12.00-12.50
Chicago, factory	13.00-13.50
Chicago, dealer	12.00-12.50
Cincinnati, dealers	10.75-11.25
Cleveland	14.50-15.00
Detroit	11.50-12.00
E. Pa., new mat.	15.50
E. Pa., old mat.	11.00-11.50
Los Angeles	12.50-13.00
Pittsburgh	15.50-16.00
St. Louis	10.00-10.50
Valleys	14.50-15.00

BUNDLED SHEETS

Buffalo, No. 1	12.00-12.50
Buffalo, No. 2	11.00-11.50
Cleveland	11.00-11.50
Los Angeles	14.00
Pittsburgh	14.75-15.25
St. Louis	7.00- 7.50
Toronto, dealers	3.50

SHEET CLIPPINGS, LOOSE

Chicago	8.50- 9.00
Cincinnati, dealers	6.75- 7.25
Detroit	8.75- 9.25
†Los Angeles	3.75- 4.00
St. Louis	6.00- 6.50

BUSHELING

Buffalo, No. 1	12.00-12.50
Chicago, No. 1	12.50-13.00
Cincin., No. 1, deal.	8.25- 8.75
Cincinnati, No. 2	3.75- 4.25
Cleveland, No. 2	8.50- 9.00
Detroit, No. 1, new	10.50-11.00
Valleys, new, No. 1	14.25-14.75
Toronto, dealers	4.00- 4.25

MACHINE TURNINGS (Long)

Birmingham	†4.50- 5.00
Buffalo	7.00- 7.50
Chicago	7.00- 7.50
Cincinnati, dealers	4.75- 5.25
Cleveland	7.50- 8.00
Detroit	5.75- 6.25
Eastern Pa.	9.50-10.00
Los Angeles	4.50- 5.00
New York	†3.50- 4.00
Pittsburgh	9.75-10.25
St. Louis	3.00- 4.00
Toronto, dealers	4.00- 4.50
Valleys	9.50-10.00

SHOVELING TURNINGS

Buffalo	7.25- 8.00
Cleveland	8.00- 8.50
Chicago	8.50- 9.00
Detroit	6.50- 7.00
Pitts., alloy-free	11.25-11.75

BORINGS AND TURNINGS

For Blast Furnace Use

Boston district	2.00
Buffalo	7.00- 7.25
Cincinnati, dealers	3.25- 3.75
Cleveland	8.50- 9.00
Eastern Pa.	6.50- 7.00
Detroit	6.25- 6.75
New York	†2.50- 3.00
Pittsburgh	8.75- 9.00
Toronto, dealers	5.00- 5.50

AXLE TURNINGS

Boston district	†7.50
Buffalo	9.50-10.00
Chicago, elec. fur.	14.00-14.50
East. Pa., elec. fur.	13.50
St. Louis	9.50-10.00
Toronto	4.25- 4.50

CAST IRON BORINGS

Birmingham	†6.00- 6.50
Boston dist. chem.	†5.75- 6.00
Buffalo	7.50- 8.00
Chicago	5.50- 6.00
Cincinnati, dealers	3.25- 3.75
Cleveland	8.50- 9.00
Detroit	6.25- 6.75
E. Pa., chemical	10.00-11.00
New York	†3.50- 4.00
St. Louis	2.50- 3.00
Toronto, dealers	4.00- 4.25

RAILROAD SPECIALTIES

Chicago	16.00-16.50

ANGLE BARS—STEEL

Chicago	15.50-16.00
St. Louis	13.50-14.00

SPRINGS

Buffalo	16.00-16.50
Chicago, coil	16.50-17.00
Chicago, leaf	15.00-15.50
Eastern Pa.	17.50-18.00
Pittsburgh	18.00-18.50
St. Louis	15.00-15.50

STEEL RAILS, SHORT

Birmingham	†12.00-12.50
Buffalo	17.00-17.50
Chicago (3 ft.)	16.00-16.50
Chicago (2 ft.)	16.50-17.00
Cincinnati, dealers	16.50-17.00
Detroit	17.00-17.50
Los Angeles	15.00-15.50
Pitts., 3 ft. and less	18.25-18.75
St. Louis, 2 ft. & less	16.25-16.75

STEEL RAILS, SCRAP

Boston district	†13.50-14.00
Buffalo	16.00-16.50
Chicago	14.00-14.50
Cleveland	17.00-17.50
Pittsburgh	17.00-17.50
St. Louis	13.50-14.00
Seattle	16.00

FROGS, SWITCHES

Chicago	14.00-14.50
St. Louis, cut	13.50-14.00

ARCH BARS, TRANSOMS

St. Louis	14.00-14.50

PIPE AND FLUES

Chicago, net	9.00- 9.50
Cincinnati, dealers	7.00- 7.50

RAILROAD GRATE BARS

Buffalo	10.00-10.50
Chicago, net	8.50- 9.00
Cincinnati, dealers	7.00- 7.50
Eastern Pa.	13.50
New York	†8.50- 9.00
St. Louis	9.00- 9.50

RAILROAD WROUGHT

Birmingham	†11.00-11.50
Boston district	†9.50-10.00
Eastern Pa., No. 1	16.00-16.50
St. Louis, No. 1	10.25-10.75
St. Louis, No. 2	12.00-12.50

FORGE FLASHINGS

Boston district	†8.50
Buffalo	12.00-12.50
Cleveland	12.00-12.50
Detroit	10.25-10.75
Los Angeles	9.00
Pittsburgh	14.50-15.00

FORGE SCRAP

Boston district	†6.50
Chicago, heavy	16.50-17.00

LOW PHOSPHORUS

Buffalo, crops	16.50-17.00
Cleveland, crops	18.00-18.50
Eastern Pa., crops	17.00-17.50
Pitts., billet, bloom, slab crops	19.00-19.50

LOW PHOS. PUNCHINGS

Buffalo	15.50-16.00
Chicago	16.50-17.00
Eastern Pa., crops	17.50-18.00
Pittsburgh	17.50-18.00
Seattle	15.00

RAILS FOR ROLLING

5 feet and over

Birmingham	†14.00-15.00
Boston	15.00-15.50
Chicago	17.00-17.50
New York	†14.50-15.00
Eastern Pa.	17.00-17.50
St. Louis	16.00-16.50

STEEL CAR AXLES

Birmingham	†15.00-16.00
Buffalo	16.50-17.00
Boston district	†16.00-16.50
Chicago, net	18.00-18.50
Eastern Pa.	21.00-21.50
St. Louis	18.00-18.50

LOCOMOTIVE TIRES

Chicago (cut)	16.00-16.50
St. Louis, No. 1	13.50-14.00

SHAFTING

Boston district	†15.25-15.75
New York	†15.50-16.00
Eastern Pa.	20.50-21.00
St. Louis, 1¼-3¾"	17.50-18.00

CAR WHEELS

Birmingham	†13.50-14.00
Boston dist., iron	†11.00
Buffalo, steel	16.50-17.00
Chicago, iron	13.50-14.00
Chicago, rolled steel	15.50-16.00
Cincin., iron, deal.	13.00-13.50
Eastern Pa., iron	16.50-17.00
Eastern Pa., steel	17.50-18.00
Pittsburgh, iron	15.00-15.50
Pittsburgh, steel	18.00-18.50
St. Louis, iron	14.50-15.00
St. Louis, steel	14.50-15.00

NO. 1 CAST SCRAP

Birmingham	†13.00-13.50
Boston, No. 1 mach.	†11.50-11.75
N. Eng. del. No. 2	12.00-12.50
N. Eng. del. textile	12.50-13.00
Buffalo, cupola	14.50-15.00
Buffalo, mach.	15.50-16.00
Chicago, agri. net	10.50-11.00
Chicago, auto net	13.00-13.50
Chicago, rail'd net	11.50-12.00
Chicago, mach. net	12.00-12.50
Cincin., mach. deal.	13.50-14.00
Cleveland, mach.	17.00-17.50
Eastern Pa., cupola	16.50-17.00
E. Pa., mixed yard	14.50
Los Angeles, net	13.50-14.00
Pittsburgh, cupola	15.25-15.75
San Francisco, del.	13.50-14.00
Seattle	12.00-14.50
St. Louis, cupola	12.00-12.50
St. Louis, agri. mach.	14.00-14.50
St. L., No. 1 mach.	14.50-15.00
Toronto, No. 1, mach., net	12.00-13.00

HEAVY CAST

Boston dist. break.	†9.75
New England, del.	12.50-13.00
Buffalo, break.	11.00-11.50
Cleveland, break, net	13.00-13.50
Detroit, auto net	13.00-13.50
Detroit, break.	10.50-11.00
Eastern Pa.	15.00-15.50
Los Ang., auto, net	13.00-13.50
New York, break.	†10.50-11.00
Pittsburgh, break	13.25-13.75

STOVE PLATE

Birmingham	†7.50- 8.00
Boston district	†8.00- 8.25
Buffalo	13.00-13.50
Chicago, net	8.00- 8.50
Cincinnati, dealers	7.00- 7.50
Detroit, net	7.50- 8.00
Eastern Pa.	13.50
New York, fdy.	†10.00-10.50
St. Louis	7.50- 8.00
Toronto dealers, net	7.50- 8.00

MALLEABLE

Birmingham, R. R.	†10.50-11.00
New England, del.	14.50-15.00
Buffalo	13.50-14.00
Chicago, R. R.	15.50-16.00
Cincin., agri., deal.	12.00-12.50
Cleveland, rail	15.50-16.00
Eastern Pa., R. R.	15.00-16.50
Los Angeles	17.50-18.00
Pittsburgh, rail	15.00-15.50
St. Louis, R. R.	12.25-12.75

Iron Ore

Lake Superior Ore

Gross ton, 51½%

Lower Lake Ports

Old range bessemer	$5.25
Mesabi nonbes.	4.95
High phosphorus	4.85
Mesabi bessemer	5.10
Old range nonbes.	5.10

Eastern Local Ore

Cents, unit, del. E. Pa.

Foundry and basic 56.63% con.	9.00-9.25
Cop.-free low phos. 58-60%	nominal

Foreign Ore

Cents per unit, c.i.f. Atlantic

Foreign manganiferous ore, 45.55% iron, 6-10% man. nom.	12.00
No. Afr. low phos.	12.00
Swedish low phos.	12.00
Spanish No. Africa basic, 50 to 60% nom.	9.00- 9.50
Tungsten. sh. ton. unit, duty pd. nom.	20.00
N. F., fdy., 55%	7.00
Chrome ore, 48% gross ton, c.i.f.	$23.00-24.00
Molybdenum ores sulphide, per lb. molybdenum contained, f.o.b. mill	0.75

Manganese Ore

Prices not including duty, cents per unit cargo lots.

Caucasian, 50-52% nom.	29.00
So. African, 50-52% nom.	29.00
Indian, 49-50%	27.00-28.00

Sheets, Strip

Sheet & Strip Prices, Pages 86, 87

Pittsburgh — Recovery in sheet and strip buying from recently depressed levels will be necessary to prevent a reduction in mill schedules. Production already has receded moderately. Automotive demand has been lighter than expected, although March tonnage rebounded to the January level and fairly steady consumption is expected during April. Prices are steady, with galvanized quotations sustained better than usual for this period. Galvanized sheet output is a trifle lower at 60 per cent, the first decline so far this year. Other flat-rolled operations show only slight change but the tendency is downward.

Cleveland—Less favorable prospects in the automotive industry and reduced activity among partsmakers cloud the outlook for flat-rolled steel. Demand from miscellaneous consumers is fairly steady, but likelihood is seen of some falling off in total business this month, following a fairly even trend in February and March. Mill backlogs are small in the absence of forward buying.

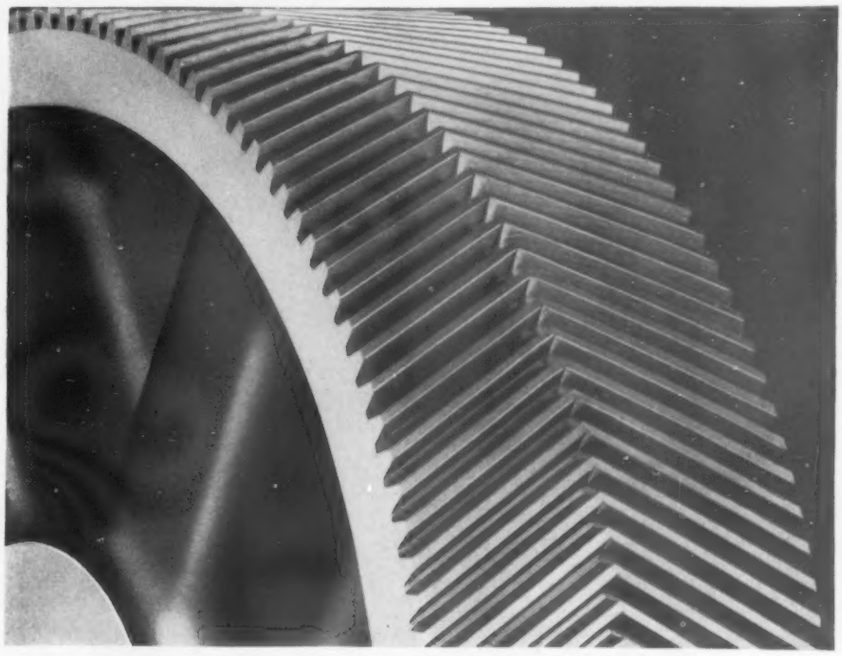
Chicago—Sales have shown practically no change since the second week of February. Automotive demand has slackened recently, although replacement of stocks of certain grades has increased. While this does not offset the general lag in automotive sheet buying, volume has been bolstered by heavier business elsewhere, with some types of sheets making a better showing than was expected. Heavy placements last fall still are deterring operations somewhat.

Boston—Lyons Iron Works, Manchester, N. H., has been awarded approximately 100 tons of hot-rolled, pickled and annealed sheets for 1940 New Hampshire license tag stock, the material to be produced by a United States Steel Corp. subsidiary. Bids closed April 3. Except for a seasonal flurry in demand for number plate material in several other states, demand is light, with jobbers placing sheet orders in small lots for prompt delivery. Incoming cold strip volume is barely maintained, with some decline in business from automobile parts makers. Rerollers have small backlogs, operations at around 50 per cent of capacity being sustained by day-to-day orders.

New York—Most sheet deliveries represent old orders, with new buying quiet. Principal consumption is by maunfacturers of household equipment. These interests bought rather heavily earlier in the year and have ordered sparingly since then, but some important fill-in purchases are expected late this month. Fabricators of metal doors and door bucks are counted on to enter the market shortly for substantial tonnages, since stocks of some are understood to be low.

Demand for narrow cold strip has slackened in some directions with tonnage moving to the automotive industry smaller. Some fair volume has been done with producers of household appliances, but no steady or sustained demand is maintained. Cold finished operations are around 50 per cent with prompt delivery specified on most incoming volume. Mills have meager backlogs.

Philadelphia — Automotive sheet requirements are declining on a further drop in specifications from assembly plants. One frame maker has completed its run on 1939 models. However, one small car builder, which got under way slowly this year, has scheduled 3000 jobs for April, 3500 for May and



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THE HORSBURGH & SCOTT CO.

GEARS AND SPEED REDUCERS

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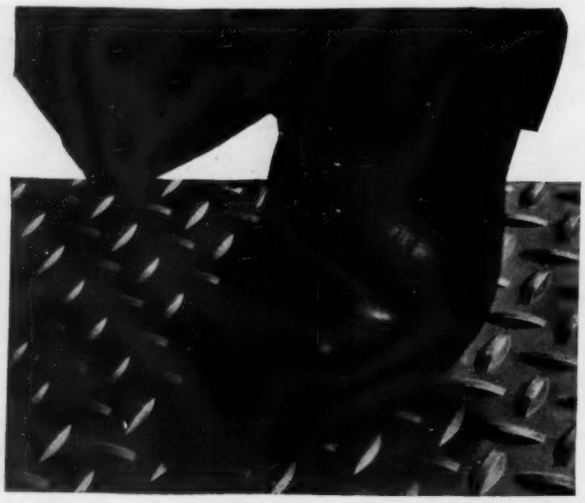
5000 for June. The Du Pont company will require nearly 300 tons of galvanized sheets for duct work in air-conditioning its new Seaford, Del., plant. A large tonnage also will be required for ventilating tunnels of the Pennsylvania turnpike. It is reported Russia will enter the market for an additional large tonnage of sheets and strip, since its own production is not up to expectations. Russia recently has been buying over 2000 tons monthly. Reduction in the Turkish tariff is not expected to aid sales immediately, because the country is short on dollar exchange.

Buffalo — Demand for sheets and strip is holding steady around recent levels but aggregate business is not coming up to expectations. Buying lacks snap and orders are being placed to fill immediate needs only. Demand is diversified with automotive specifications still limited.

Cincinnati — Seasonal improvement in sheet business has been below expectations. Demand for spiral welded pipe is heavier, while spotty gains are noted in galvanized sheets. Other needs vary only slightly from March specifications, with automotive requirements disappointing.

Birmingham, Ala. — Sheets are holding close to the capacity mark. Output, as it has been for some time, is fairly well divided between manufacturers' and roofing sheets. Strip is not in great demand as yet, although production has been stepped up somewhat in anticipation of the forthcoming cotton season.



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38 SOUTH DEARBORN STREET, CHICAGO

Sheets • Strip • Tin Plate • Bars • Plates • Structurals • Piling • Rails • Reinforcing Bars

Plates

Plate Prices, Page 86

New York—Plate business is less active than at any time so far this year, with the tense political situation abroad a depressing factor. However, ship specifications are well sustained, with additional business from the navy and maritime commission in prospect. The latter will place contracts before fall on three high-speed passenger liners for Oriental service. Turl Engineering Works, this city, recently noted as having been awarded 1100 caissons for a bridge at Portsmouth, N. H., has withdrawn. Jones & Laughlin Steel Corp. will supply and fabricate this material.

Boston — Award of 400 tons for a standpipe, Framingham, Mass., is outstanding. However, several thousand tons are pending for sewer construction, including tunnel ribs. Part of this tonnage will be placed by a New York contractor through a temporary Boston office. Shipyard releases continue steady, but such tonnage is confined largely to one eastern Pennsylvania mill with the exception of specifications from navy yards which are more widely distributed. Miscellaneous buying is slack with shipments to boiler, structural and railroad shops light.

Philadelphia—Plate makers are disappointed over the volume of miscellaneous small-lot tonnage. Ship plate releases are appearing in lots of several hundred tons, but no large tonnage has been issued yet. It is pointed out the Newport News Shipbuilding & Dry Dock Co. may issue releases fairly soon on the 10,000 tons of plates required for an aircraft carrier just booked, since considerable shop work will be necessary before the keel is laid. Reports persist that the old Cramp yard will be rebuilt to handle part of the maritime commission work, more of which is scheduled this year. The navy has called for bids May 24 from private shipbuilders on four torpedo boat destroyers of 1630 tons each, three submarines of

1475 tons each and one submarine of 800 tons. In addition, navy yards will build an equal number of the same types of warcraft.

Birmingham, Ala. — Plates have tapered off somewhat since the beginning of the second quarter. Specifications for shipbuilding, expected to be ready within 30 days, will add materially to output of that product in this territory.

San Francisco—Most plate inquiries are in lots of less than 100 tons and only three are larger. Award of close to 700 tons of welded steel or 678 tons of lapwelded pipe for Fallbrook, Calif., is still pending. To date this year 14,792 tons have been booked compared with 12,218 tons for the corresponding period in 1938.

Seattle—Shops report no inquiry for large jobs, although there is a fair volume of spring work in lots of less than 100 tons. About 300 tons are involved in two contracts for a snag boat and derrick hull, bids in to United States engineer, Seattle and Portland.

Bars

Bar Prices, Page 86

Cleveland—Bar demand is quieter, principally the result of reduced activity among automotive partsmakers. Releases of parts have been curtailed lately, indicating lower production in coming weeks. Miscellaneous bar users are holding their requirements fairly steady, but improvement generally is lacking, and the tendency to refrain from ordering beyond early needs continues.

Chicago—With a decrease in automotive demand being felt, requirements of tractor manufacturers are one of the main factors in the local market for carbon and alloy steel bars. General buying is being done by a wide range of interests, but individual lots are small, indicating buying being done only for immediate needs. The week has been quiet, with little or no change being noted in volume of sales, following a reported general decline the previous week.

Boston—A well diversified demand for alloy steel bars in small lots accounts for most activity in bars, with plain carbon material slack. Machine tool builders continue to take a fair volume of alloys. Cold-finished bars are moving slowly. Shipyard specifications are steady, but demand by railroads is light.

New York—Except for such steel required by government shops, airplane builders and ship yards, bar business is decidedly spotty. Sales recently have been the lightest in many weeks. Machine tool builders have curtailed specifications, although this appears to be only temporary. Railroad tonnage is small, and jobbers are specifying lightly.

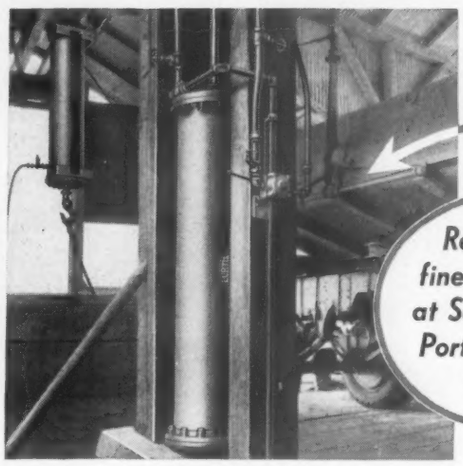
Philadelphia — Slower specifications largely reflect easier demand for steel out of warehouse. Some seasonal improvement is noted in certain directions, but this is insufficient to offset the general declining tendency.

Buffalo—Demand for steel bars is holding at fairly good levels, although production is slightly below the peak of a year ago. Motor orders still constitute a fair percentage of business. Expansion in structural inquiries and releases, however, is one of the main market supports.

Birmingham, Ala.—Although not quite as active as in the past few weeks, bar output is holding up satisfactorily. Considerable local tonnage is being absorbed by manufacturers of agricultural implements.

CURTIS AIR HOISTS

on a tough job



Records show fine performance at Southern States Portland Cement Company

Two Curtis Air Hoists at the Rockmart, Georgia plant of the Southern States Portland Cement Company have helped to speed up operations, and reduce costs. One hoist is used to tilt loaded dump trucks into the hopper; the other to lift large boulders stuck in the crusher. Each does its job dependably and efficiently requiring a minimum of attention. (A third Curtis hoist has since been installed.)

This installation is an example of the limitless uses to which Curtis Air Hoists can be put even under unfavorable conditions. Simple in construction with only one moving part, Curtis Air Hoists are rugged and immune to injury from overloads or bad atmospheric conditions. They can be operated with ease and accuracy by unskilled labor. First cost is low, the power consumption small, and upkeep negligible.

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Gentlemen: Please send me your booklet, "How Air is Being Used in Your Industry," and further information on Curtis Air Power Hoists.

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City _____

Pipe

Pipe Prices, Page 87

Pittsburgh—Better building activity is causing a heavier movement of standard pipe from consigned stocks. Mill prices are firm, but some weakness prevails in secondary markets. March business in oil country pipe was ahead of February, but the increase was less than seasonal. In many cases only enough drilling is being done to secure leases. Little tonnage is going for pipe lines except for a few feeder lines. Demand for pressure tubing has been stimulated by slightly heavier orders from railroads, though the total remains unsatisfactory. Mechanical tubing business is holding, with March showing a substantial gain over February.

Cleveland—Standard pipe demand has yet to be influenced markedly by a seasonal betterment in building activity. Shipments lately have shown little change from the March rate. Oil country demand is retarded by slow drilling operations, but fair business is appearing for refinery work and the outlook in this division is relatively bright. Proposed national legislation to divorce pipe line subsidiaries from oil producers is thought likely to deter installation of major lines for the time being.

Chicago — A waterworks for Grand Rapids, Mich., on which alternate bids on cast iron, steel and concrete are being asked for the pipe involved, may take 20,000 to 25,000 tons of cast pipe if this type is chosen. A materially smaller tonnage would be involved in the case of steel pipe. Alabama Pipe Co. is reported low on 1438 tons for Chicago, which city also is in the market for 368 tons of 30-inch pipe and 13 tons of fittings, bids April 10.

Boston—Cast pipe buying is heavier, close to 3500 tons having been purchased, including 1500 tons for Bourne, Mass., placed with the Everett, Mass., foundry. The same foundry also booked 1939 requirements for Wellesley, Mass., while Newport, R. I., has bids on 1085 tons, part of which has been placed.

New York—Pending pipe business is headed by the proposal of Socony-Vacuum Oil Co. to build a 360-mile line of 10-inch pipe from Wood River, Ill., to Lima, O., involving about 40,000 tons. Merchant pipe orders show little seasonal improvement, although there are several sizable projects for which tonnage still is pending.

Birmingham, Ala. — Pipe plants, by virtue of a considerable volume of miscellaneous business, have been enabled to step up production schedules to a five-day week, generally. Inquiries are said to be somewhat more numerous, with the result that comparatively satisfactory production is expected for several weeks, at least.

San Francisco—Only two cast iron pipe inquiries of size are in the market and pending business does not exceed 2000 tons. An award is expected to be made within the next two weeks on 368 tons of 4 and 6-inch pipe for Mesa, Ariz. So far this year 6691 tons have been placed, compared with 8693 tons for the same period a year ago.

Seattle—Demand is slow, no important projects being up for figures. Several Pacific Northwest cities and districts are planning sizable jobs but are awaiting allocation of federal funds. Pacific Water Works Supply Co., Seattle, has been awarded an unstated tonnage of steel, 4 and 6-inch pipe and accessories for District 49, Seattle. Kent, Wash., plans an $18,400 system extension

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MORTON'S SALT TABLETS

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MORTON SALT COMPANY CHICAGO, ILLINOIS

for which federal funds have been approved.

Cast Pipe Placed

1500 tons, 12-inch and under, Bourne, Mass., to Warren Foundry & Pipe Corp., Everett, Mass.

585 tons, including 335 tons, 20-inch, Newport, R. I., to R. D. Wood & Co., Florence, N. J., and 250 tons, 6 to 16-inch pipe and fittings, to Warren Foundry & Pipe Corp., Everett, Mass.

370 tons, 20-inch class C, Boston, to United States Pipe & Foundry Co., Burlington, N. J.

100 tons, 6 and 12-inch, Ipswich and Peabody, Mass., to Warren Foundry & Pipe Corp., Everett, Mass., through procurement division, Boston.

Cast Pipe Pending

500 tons, small sizes, Newport, R. I.; bids in.

200 tons, 8 to 12-inch; bids in at Fort Lewis, Wash.

Steel Pipe Pending

40,000 tons, 10-inch line pipe for Socony-Vacuum Oil Co. Inc., New York, for construction between Wood River, Ill., and Lima, O.

Wire

Wire Prices, Page 87

Pittsburgh—Jobber demand for merchant wire products continue to increase. The buying season is late, but business shows signs of fair development. Manufacturers' wire activity has declined slightly, but not enough to indicate a definite downward trend. Producers still are hopeful that heavier automotive buying will develop this month. Automotive releases have been reduced lately.

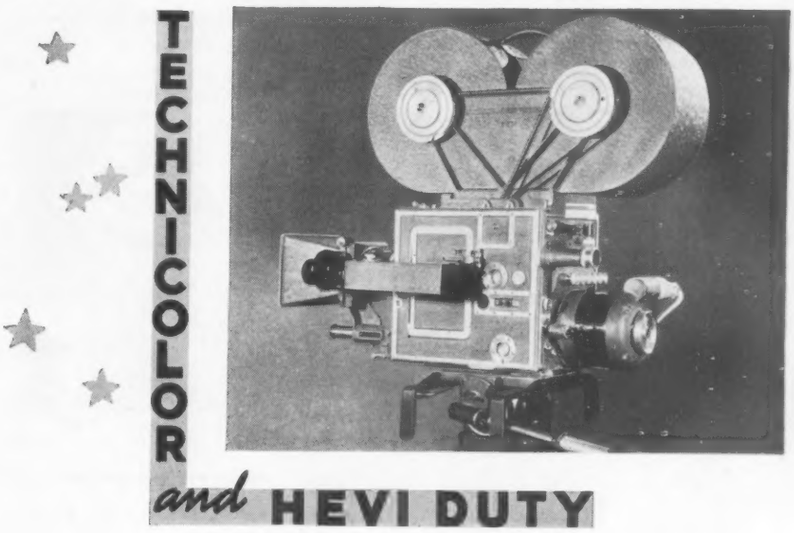
Cleveland—Changes in wire business are slight, but except for occasional gains in jobber demand for merchant products the trend in sales is unchanged or lower. Prospects for heavier requirements in the automotive industry the next 30 days have been dimmed somewhat, although fairly steady consumption continues among miscellaneous users of manufacturers' wire.

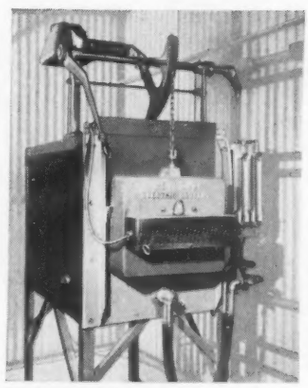
Chicago — Demand is quiet and moderately below recent levels. Wire buying by automotive interests continues to lag, and there is some question whether anticipated improvement in total business this month will materialize. At the same time, a favorable comparison with March is looked for.

Boston—Incoming wire volume has failed to improve, and aggregate tonnage is barely maintained. All orders are for prompt delivery, with finishing operations slightly better than 50 per cent. Backlogs, having been well reduced, shipments are about in line with incoming volume. Ingot operations at all New England steelworks are now below finishing schedules, a fair stock of semifinished steel having been accumulated in each instance.

New York—Wire buying is barely maintained at the recent reduced rate, with eastern finishing operations around 50 per cent. While in spots a fair demand for a few specialties prevails, most wire products, including merchant goods, are lagging and more consuming industries are less active. Improvement having failed to materialize last month, sellers are more uncertain as to April business which to date has not turned upward. Rod business is light and the bulk of finished goods orders are for small tonnages for prompt delivery.

Birmingham, Ala.—Wire products have shown the most consistent demand of any major steel product. Production is at about 75 per cent.





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HEVI DUTY ELECTRIC COMPANY

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MILWAUKEE, WISCONSIN

Behind the Scenes with STEEL

Opry Fan

■ Last week was opera week here in Cleveland. The little woman had notified us well in advance that we were slated for Friday night's performance of *Lohengrin,* and we couldn't get out of it in spite of feigning a broken leg and a splitting headache. And so, for what seemed like hours we squirmed and grew restless while *Elsa* and *Lohengrin* build up to the high spot of the whole affair—the wedding march. The curtain is slowly drawn on an empty stage, and the orchestra takes up the first strains of music and the audience of over 9000 is all pins and needles waiting for the big entree. And then, right at this crucial moment, the dizziest looking bozo comes trotting right smack across the stage, coat tails flying, and hell bent for the other side, for what reason no one will probably ever know.

Jolly Ol' Train

■ We sneaked an extra half-hour for lunch the other day and took a peek at *The Coronation Scot* which the London, Midland and Scottish Railway had on exhibition at the terminal here on a tour prior to parking at the New York World's Fair this summer. She is rilly quite a train, holding the British speed record of 114 m. p. h. and regularly making her daily run of 400 miles at an average of over 60. Like all English trains, she (the attendants call her she) is a bit smaller than the American streamliners. The permissible limits of height and width are smaller in England because the British railways had to buy their own right of ways and naturally they bought just as little as they could get away with, while the U. S. roads had their right of ways tossed in their laps. The coaches are all very nicely decorated with many kinds of choice woods used. There were dozens of *empty* bottles of Scotch on display at the cocktail bar, carefully guarded, nevertheless, by a uniformed London Bobbie. Two Bobbies guarded each of the 8 cars against souvenir hunters, and two Cleveland cops guarded the Bobbies. A school kid in front of us lifted up the hand-embroidered quilt in one of the sleeping compartments and looked furtively under the bed. There was only a small wash stand in the room. Everything worked out all right, however, and the kid and ourselves stopped off at Harvey's afterwards for a chocolate soda.

Week Late

■ This cartoon from the *Chicago Tribune* should have illustrated the lead story in STEEL last week.

NOT EXACTLY AN INCENTIVE

Lady Nicotine

■ For some unexplainable reason, we decided last week to stop smoking. Never again will the filthy weed touch our lips. Well, not for three weeks, anyway because in order to bolster our courage we had to back it up with a cash money bet with some of the skeptics around the office. As we move into the third day (with a big stag luncheon scheduled for this noon) our pulse is barely noticeable, our digestion poor, and our respiration jerky. Woe is us.

Nice Thought

■ One of our friends, with beautiful sense of expression, last week said: When Ann laughs the angels in heaven must smile.

SHRDLU

—The Market Week—

Rails, Cars

Track Material Prices, Page 87

Railroad buying is light in rails and cars but about 4000 cars are pending, with expectation a major portion will be placed this month. Further rail buying is also likely to be done, as important roads have not yet placed their 1939 requirements. The Santa Fe is expected to buy about 50,000 tons to complete its tracklaying program, in addition to a large carryover from last year.

Freight cars placed in March totaled 800 units. This compared with 2259 cars in February and only three in January, and brought the total for the first quarter up to 3062. This latter figure compared with 814 in the corresponding period of 1938, 30,933 in the same period of 1937, and 9582 in the first three months 1936.

The St. Louis South Western has ordered 100 underframes for 50-ton Hart convertible ballast cars and 100 for 40-ton flat cars from American Car & Foundry Co., New York.

Merchants Dispatch Inc. has awarded about 2400 tons of plates, shapes, bars, wheels, axles and special castings for 200 seventy-ton cement cars to be built in its own shops at Rochester, N. Y., beginning June 1.

	1939	1938	1937	1936
Jan.	3	25	17,806	2,050
Feb.	2,259	109	4,972	6,900
March	800	680	8,155	632
3 mos.	3,062	814	30,933	9,582
April	.....	15	9,772	4,427
May	.....	6,014	4,732	8,900
June	.....	1,178	548	5,200
July	.....	0	1,030	7,229
Aug.	.....	182	1,475	225
Sept.	.....	1,750	1,216	1,750
Oct.	.....	2,537	1,355	2,210
Nov.	.....	1,232	275	1,550
Dec.	.....	2,581	275	23,450
Total	.....	16,303	51,611	64,523

Car Orders Placed

Merchants Dispatch Inc., 200 seventy-ton cement cars, to own shops, Rochester, N. Y.

St. Louis Southwestern, 100 steel underframes for 50-ton convertible ballast cars and 100 for 40-ton flat cars, to American Car & Foundry Co., New York.

Weyerhaeuser Timber Co., Tacoma, Wash., 200 railroad logging cars, to Pacific Car & Foundry Co., Seattle.

Rail Orders Placed

Bangor & Aroostook, 2551 tons, to Bethlehem Steel Co., Bethlehem, Pa.

Boston Elevated, 1325 tons, to Bethlehem Steel Co., Bethlehem, Pa.

Buses Booked

American Car & Foundry Motors Co., New York: Thirty-one for Aronimink Transportation Co., Upper Darby, Pa.; four for Georgia Power Co., Atlanta,

Ga.; three for Jamaica Buses Inc., Jamaica, N. Y.; two for Quaker City Bus Co. Inc., Ocean City, N. J.; two for Safeway Trails Inc., New York; two for Southern Kansas Greyhound Lines Inc., Kansas City, Mo.; two for Saugus Transit Co., Saugus, Mass.

J. G. Brill Co., Philadelphia: Fifty-two single-motor 40-passenger trolley coaches for Delaware Electric Power Co., Wilmington, Del.

Shapes

Structural Shape Prices, Page 86

New York — Estimated steel requirements for the twin suspension bridge, Battery Park, Manhattan, to Hamilton avenue, Brooklyn, approximate 100,000 tons, about three quarters to be structural material for the main crossing, approaches and ramps. Approval of the war department for the structure still pends. Structural contracts include close to 13,000 tons, miscellaneous material requiring little shop work for two addition sections, Delaware Aqueduct, Ulster county, New York. New inquiry is slightly heavier, including 4500 tons for Brentwood, N. Y. state hospital buildings on which Turner Construction Co., New York, is low.

Pittsburgh—Awards remain disappointing, although there have been two fairly large inquiries announced recently. The new awards are almost entirely on public projects.

Cleveland—Mt. Vernon Bridge Co., Mt. Vernon, O., is low on 1800 tons for the Carter road bridge superstructure here. Awards include 1800 tons of H piling for the Cuyahoga river straightening project here to Carnegie-Illinois Steel Corp. and 670 tons or 25,000 feet of pipe piling for the East 21st bridge, Lorain, O., to National Tube Co., Lorain. Inquiries are expected soon on 3500 tons for two vertical lift bridges over the Cuyahoga river; also 3000 tons for the Marshall and Erie street bridges, Youngstown, O., and about 6700 tons will be required for the Erie avenue and East 21st bridges at Lorain, O.

Chicago—Continued evidences of the spring improvement has been noted here. Tonnage pending disposition is increasing weekly, while closings on projects that have been hanging fire throughout the winter are expected soon.

In reference to the general state of finished steel ordering, some quarters are hopeful the structural and plate demand will increase sufficiently to offset losses that may be noted in other lines during the second quarter, such as in rail orders.

Boston — Bridge contracts total 500 tons, mostly small spans, including two for Connecticut, 295 tons, the remainder I-beam spans, Vermont. Building construction needs are light, public projects absent with the exception of several schools. Awards include 240 tons for a bottling plant, Worcester. Fabricated and erected structural steel prices are soft with most of the moving tonnage going to shops outside the New England district.

Philadelphia—McCloskey & Co., Philadelphia, is low on an office building, Harrisburg, requiring 1125 tons of structurals and 160 tons of bars. Low cost housing project here will take 1000 tons of structurals and 300 tons of bars, bids April 16.

Buffalo—While major activity is centered on school projects several sizable jobs are expected to be up for bids soon. First of these is the new $1,200,000 Kleinhans Music hall on which foundation work is now underway. The $2,700,000 new convention hall is also expected to be underway here in the near future. Another large project pending is a bridge to replace the collapsed Honeymoon span, Niagara Falls.

Birmingham, Ala. — Structural shapes have found a somewhat widened market, following inactivity the past two weeks. Indications are that highway work will create a rather steady demand for some weeks. Production is estimated at better than 65 per cent.

San Francisco—The only award of size involved 300 tons for 12 oil derricks, Long Beach, Calif., taken by an unnamed interest. Awards totaled 1474 tons and brought the aggregate to date to 36,870 tons, compared with 29,510 tons last

Shape Awards Compared

	Tons
Week ended April 8	**15,805**
Week ended April 1	**32,489**
Week ended March 25	**15,840**
This week, 1938	**29,484**
Weekly average, year 1938	**21,566**
Weekly average, 1939	**24,696**
Weekly average, March	**21,240**
Total to date, 1938	**223,178**
Total to date, 1939	**321,047**

Includes awards of 100 tons or more.

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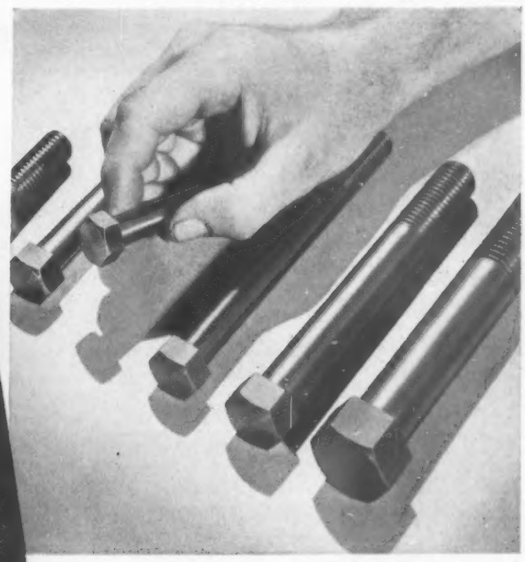

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year. Pending business does not involve over 4000 tons.

Seattle—Largest contract awarded by private industry in several weeks went to Pacific Car & Foundry Co., Seattle, which will build 200 connected truck-body railroad logging cars for the Weyerhaeuser Timber Co., involving about 600 tons of shapes and plates. Bethlehem Steel Co., San Francisco, is low at $50,823 on 375 tons for seven power substations for the Bonneville authority. Tacoma will receive bids April 10 for a steel municipal light substation.

Shape Contracts Placed

6500 tons, including tunnel ribs, structural tunnels supports, reinforcing material and inner lining, contract 316, Delaware aqueduct, Gardiner, Plattekill and Marlboro, Ulster county, New York, to Carnegie-Illinois Steel Corp., Pittsburgh; Walsh Construction Co., New York, general contractor.

1800 tons, piling, Cuyahoga river straightening project, Cleveland, to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

1000 tons, Delaware aqueduct, contract 313, Wawarsing, N. Y., for New York City, to Archer Iron Works, Chicago.

750 tons, bridge over Kentucky river, Irvine, Estill county, Kentucky, to Pittsburgh-Des Moines Steel Co., Pittsburgh.

670 tons, 25,000 feet of pipe piling, East Twenty-first street bridge, Lorain, O., to National Tube Co., Pittsburgh; Great Lakes Dredge & Dock Co., Cleveland, general contractor.

625 tons, piling, Erie avenue bridge, Lorain, O., to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

600 tons, including plates, 200 logging cars for Weyerhaeuser Timber Co., Tacoma, to Pacific Car & Foundry Co., Seattle.

550 tons, court house, Elizabeth, N. J., to H. R. Goeller, Hillside, N. J.

450 tons, fourth section, Chicago subway, to American Bridge Co., Chicago, by John Marsch, general contractor.

400 tons, apartment, East 156th street, New York, to Harris Structural Steel Co., Plainfield, N. J.

300 tons, Erie avenue bridge, Lorain, O., to Mt. Vernon Bridge Co., Mt. Vernon, O.; through Great Lakes Dredge & Dock Co., Cleveland.

300 tons, 12 oil derricks, Long Beach Oil Development Co., Long Beach, Calif., to unnamed interest.

250 tons, building, Sikorsky Aviation Corp., Stratford, Conn., to Truscon Steel Co., Youngstown, O.; through Edward Moss & Sons, Bridgeport, Conn.

225 tons, Washington high school stadium, Massillon, O., to Fort Pitt Bridge Works, Pittsburgh, erroneously reported in April 3 issue as placed with American Bridge Co., Pittsburgh.

225 tons, grade separation bridge, Inkster, Mich., for Wayne county, to Fort Pitt Bridge Works, Pittsburgh.

205 tons, Cross island parkway grade separation, New York, to American Bridge Co., Pittsburgh.

200 tons, community and recreation building, Sault Ste. Marie, Mich., to Bethlehem Steel Co., Bethlehem, Pa.

195 tons, state bridge, Exchange street, Athol, Mass., to American Bridge Co., Pittsburgh.

190 tons, Memorial hospital, Rome, N. Y., to American Bridge Co., Pittsburgh; through White Construction Co.

175 tons, girder spans, Rathbun, Iowa, for Chicago, Milwaukee, St. Paul & Pacific railroad, to Bethlehem Steel Co., Bethlehem, Pa.

175 tons, bridge, Athol, Mass., to American Bridge Co., Pittsburgh.

140 tons, transportation building 74, Washington, for District of Columbia, to Belmont Iron Works, Philadelphia.

105 tons, garage, Gordon Baking Co., Long Island City, N. Y., to Belmont Iron Works, Philadelphia.

Shape Contracts Pending

100,000 tons, three-fourths structurals, twin suspension bridge and approaches, Battery Park, New York-Hamilton avenue Brooklyn, to be erected by Triborough bridge authority, New York; financing now in progress with approval of war department likely.

4500 tons, state hospital buildings, Brentwood, N. Y.; Turner Construction Co., New York, low.

3700 tons, superstructure, East Twenty-first street bridge, Lorain, O.; bids April 18.

3500 tons, two vertical lift bridges, Cuyahoga river, Cleveland; bids soon.

3000 tons, Erie avenue bridge superstructure, Lorain, O.; bids soon.

3000 tons, Marshall and Erie street bridges, Youngstown, O.; bids soon.

1870 tons, Carter road bridge, Cleveland; Mt. Vernon Bridge Co., Mt. Vernon, O., low.

1800 tons, bridges, Sacramento river, Redding, Calif.; bids to bureau of reclamation, April 21.

1225 tons, office building, liquor control board, Harrisburg, Pa.; McCloskey & Co., Philadelphia, low; also 160 tons of bars.

1100 tons, contract 6, East River drive, New York; J. Rich Steers Inc., New York, low.

1000 tons, plant building, Celanese Corp., Narrows, Va.; Hughes-Foulkrod Co., Philadelphia, general contractor.

1000 tons, housing project, Philadelphia; bids April 26.

700 tons, grade separation, Staten Island, N. Y., for Staten Island Rapid Transit Co.

675 tons, Sideling hill tunnel, Pennsylvania turnpike commission; Arundel Corp., low.

600 tons, grade elimination, Nugenot, Va.; bids April 11.

600 tons, grade crossing, Great Kills, Staten Island, N. Y.; bids April 11.

600 tons, addition, Bowen building, Washington; bids in.

500 tons, social security building, Washington; bids April 26.

450 tons, power house, Kansas Power & Light Co., Abilene, Kans.

375 tons, Laurel Hill tunnel, Pennsylvania turnpike commission; Hunkin-Conkey Construction Co., Cleveland, low.

375 tons, seven power substations for Bonneville authority; Bethlehem Steel

Co., Bethlehem, Pa., low.

350 tons, factory building, for Allis-Chalmers Mfg. Co., Pittsburgh.

331 tons, reverse flow coaster gates, Grand Coulee dam, Wash., specification 836; American Bridge Co., Pittsburgh, low.

315 tons, Clyde central school, Galen, N. Y., for board of education.

300 tons, Woolworth building, New Orleans.

280 tons, Wrightwood avenue viaduct, Chicago; Northern Bridge Co., low bidder.

280 tons, apartment, Wynnewood, Pa.; Nelson-Pedley Co., Philadelphia, general contractor.

275 tons, St. Elizabeth hospital, Washington, for United States government.

250 tons, St. Louis & San Francisco railroad bridge, Moselle, Ill.; bids in.

225 tons, 1939 plant extension, for Lever Bros., Edgewater, N. J.

220 tons, auditorium, Lake Charles, La.

220 tons, Mills bridge, Tillamook county, Oregon; bids opened.

215 tons, buildings, for Draper Corp., Hopedale, Mass.

210 tons, highway bridge, McNamara, Mont.

200 tons, Bedford dwellings, for Pittsburgh housing authority, Pittsburgh.

175 tons, theater building, Oswego, N. Y., for Bridge & Second Street Realty Corp.

125 tons, addition to building, for Elkland Leather Co., Elkland, Pa.

125 tons, underpass, specification 1209-D, Antler, Calif., for bureau of reclamation.

120 tons, state bridge, Searsboro, Iowa.

117 tons, bridges, for Alaska railroad commission; bids opened at Seattle.

Unstated, 13 high transmission towers for Bonneville authority; Fritz Ziebarth, Long Beach, Calif., low.

Unstated, five span, 445-foot state bridge, Big Blackfoot river, Mont.; Portland Bridge Co., Portland, Oreg., general contractor.

Unstated, Pacific avenue power substation, Tacoma, Wash.; bids April 10.

Reinforcing

Reinforcing Bar Prices, Page 87

New York—Reinforcing steel contracts are slightly more numerous, approximating 2500 tons. Pending work, most of which already bid, is estimated at around 6000 tons, including 3000 tons for a section of the East River drive, New York. More tonnage for New Jersey state highway and bridge projects pends, although highway needs for New York state are lagging. Prices are moderately steadier, but the bulk of tonnage still moves under listed quotations.

Pittsburgh — Reinforcing awards are holding at the level of recent weeks, with fair tonnages pending and larger projects awaiting clearance from engineers and estimators before reaching the bidding stage. These are largely public projects on which initial work was done late last year. In most instances it has been a jam in technical divisions which held up the work.

Cleveland—Inquiries from private sources continue disappointing, but a fair volume of work from public channels is still appearing. E. Elford Co., Columbus, O., has been awarded 270 tons for a state university mens' dormitory, Columbus. Awards are expected soon for an auditorium, Oberlin, O., involving 250 tons and for a mill run storm sewer, Steubenville, O., requiring 300 tons. Prices continue weak with keen competition noted even on the small tonnage work.

Chicago — Demand continues brisk, with difficulty still encountered in estimating pending projects. Large volume of minor tonnages is growing, involving considerable private work. Chicago subway continues the most prominent factor. Merritt, Chapman & Scott, New York, is low on the general contract for section S-4A, and Herlihy Mid-Continent Co., Chicago, for section S-4B, bids April 6.

Philadelphia—Interest in the reinforcing market has been enlivened by an announcement of the bidding date, April 26, for the Security board office building, Washington, taking 900 tons of reinforcing and 500 tons of shapes. Flood control work is more promising with projects planned in New York, Pennsylvania and Richmond, Va., latter involving a $2,000,000 dam. Fair volume of small jobs continue to appear for bids.

San Francisco—Demand has receded further and the market remains inactive at the moment. Awards aggregated 1090 tons, bringing the total to date to 56,814 tons, compared with 25,868 tons in 1938. Unnamed interest secured 300 tons for a postoffice at Riverside, Calif. The largest pending project involves from 2000 to 3000 tons for a parcel post building at San Francisco, bids April 18.

Seattle — Public work projects continue to furnish the bulk of awards, industrial demands being subnormal. Plants are operating as

Concrete Bars Compared

	Tons
Week ended April 8	3,852
Week ended April 1	11,872
Week ended March 25	9,113
This week, 1938	2,872
Weekly average, year, 1938	6,959
Weekly average, 1939	11,291
Weekly average, March	10,279
Total to date, 1938	68,951
Total to date, 1939	146,789

Includes awards of 100 tons or more.

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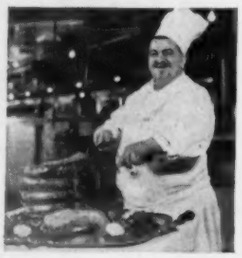

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Cleveland

orders accumulate. Bethlehem Steel Co. was awarded 263 tons for the Coulee dam and is low on 2220 tons for the same project. This job is expected to be rolled at the Seattle mill. Denver opened bids March 30 for furnishing 28,102 pieces bars, tonnage unstated, for the Roza diversion dam, Washington state.

Reinforcing Steel Awards

475 tons, paving, two contracts, Circumferential highway, New York, to Seaboard Steel Products Co., National Excavation Co., New York, general contractor.

435 tons, sewer and paving, Southern Parkway, Queens, N. Y., to Igoe Bros. Co., New York; through P. Tomasetti Contracting Co., New York.

415 tons, sewage disposal plant, New Haven, Conn., to Concrete Steel Co., New York.

350 tons, men's dormitories, University of Michigan, Ann Arbor, Mich., to Jones & Laughlin Steel Corp., Pittsburgh; through Taylor & Gaskin, Detroit.

300 tons, postoffice, Riverside, Calif., to unnamed interest.

275 tons, East Twenty-first street bridge, Lorain, O., to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

270 tons, State University dormitory, Columbus, O., to E. Elford Co., Columbus, O.

263 tons, Coulee dam project, to Bethlehem Steel Co., Seattle.

175 tons, relief sewer, West New York, N. J., to Bethlehem Steel Co., Bethlehem, Pa., through Faltoute Iron & Steel Co., Newark, N. J.

154 tons, invitation 4/7956, procurement division, U. S. treasury, Columbus, O., to Republic Steel Corp., Cleveland; through Patterson-Leitch, Cleveland.

150 tons, postoffice, Venice, Calif., to unnamed interest.

150 tons, high school auditorium, El Monte, Calif., to Consolidated Steel Corp., Los Angeles.

150 tons, Erie avenue bridge, Lorain, O., to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

140 tons, power plant, San Diego Consolidated Gas & Electric Co., San Diego, Calif., to unnamed interest.

125 tons, East Park school, Poughkeepsie, N. Y., to Ceco Steel Products Co., Jersey City, N. J.

130 tons, health service building, Ann Arbor, Mich., to Truscon Steel Co., Youngstown, O.

125 tons, Pilgrim state hospital, Brentwood, N. Y., to Bethlehem Steel Co., Bethlehem, Pa.

110 tons, building, Anchor Hocking Glass Co., Salem, N. J., to Bethlehem Steel Co., Bethlehem, Pa.

100 tons, addition to Kern general hospital, Bakersfield, Calif., to unnamed interest.

100 tons, apartment, Wynnewood, Pa., to American Steel Engineering Co., Philadelphia; through Nelson-Pedley Co., Philadelphia.

Reinforcing Steel Pending

9000 tons, social security building, Washington; bids April 26.

3000 tons, contract 6, East River drive, New York; J. Rich Steers Inc., New York, low; bids April 3.

2210 tons, Coulee dam project, Bethlehem Steel Co., low.

2000 to 3000 tons, parcel post building, San Francisco; bids April 18.

850 tons, flood control, Conemaugh river, army engineers, Johnstown, Pa.

500 tons, viaduct, Providence, R. I.

400 tons, Rock creek sewer, Washington.

300 tons, housing project, Philadelphia; bids April 26.

280 tons, invitation 4/7910, procurement division, U. S. treasury, Columbus, O.; Builders Structural Steel Co., Cleveland, low bidder.

250 tons, six infirmary buildings, Willowbrook, N. Y.

200 tons, contract No. 3, Harrisburg water supply system, Harrisburg, Pa.; Edward H. Ellis, Westerville, N. J., general contractor; also 175 tons of plates.

200 tons, garage, Monroe street, Chicago.

200 tons, housing project, blocks F and G, Syracuse, N. Y.

158 tons, auditorium for Marina junior high school, San Francisco; Monson Bros., 475 Sixth street, San Francisco, awarded general contract.

150 tons, treasury department, invitation 52,906; bids opened.

150 tons, dormitory, South Bend, Ind.

144 tons, addition to hospital, Palo Alto, Calif.; bids opened.

140 tons, assembly hall for high school, Sacramento, Calif.; general contract to Campbell Construction Co., Sacramento, Calif.

140 tons, soy bean elevator, Des Moines, Iowa.

139 tons, invitation OS-12800, state purchasing bureau, Maryland.

135 tons, elementary school, Davenport, Iowa.

122 tons, invitation WP-9-C-336, procurement division, U. S. treasury department, bids April 7, state procurement office, Baltimore.

120 tons, addition, Tobey hospital, Wareham, Mass.

100 tons, sewage disposal plant, Bryan, O., Bever & Morris, Cleveland, low.

Unstated, 28,102 pieces reinforcing bars, for Roza project; bids in at Denver.

Pig Iron

Pig Iron Prices, Page 88

Cleveland — Shipments are fairly steady, but consumption is affected adversely by reduced requirements of automotive interests. Operations of jobbing foundries are maintained despite absence of sufficient backlogs to permit scheduling casting production far ahead. Improvement in building activity has yet to be reflected in heavier pig iron demand from pipe makers. Pig iron buying generally is in small lots for prompt delivery.

Chicago—Shipments during first week of April show no change from same period last month, same being true of by-product foundry coke movements. Thursday of last week was indicated by one interest as being the heaviest day for receipt of

iron shipping orders in many weeks past. Estimates for the month as a whole, however, do not point to any improvement over March, total shipments expected to be on a par.

Boston — Slackening demand for pig iron has been complicated by truck strikes in Rhode Island and shipments are down. The situation has handicapped consumers buying in small lots, although melt has failed to show improvement, having declined in some instances. Buying is in small lots with prices generally firm.

New York—Pig iron shipments are well ahead of incoming business. The melt continues light, with many foundries unable to move their operations above three days a week. With the advance of spring, heavier production of pipe and building hardware is looked for. Machinery requirements are perhaps the most active currently.

Philadelphia—Coke shipments indicate foundry operations may be slipping slightly, although March was the best month since June, 1937. New business is quiet with prices steady, except for a reported few odd-lot offerings of distress iron.

Cincinnati—Shipments are steady at first quarter levels, but consumption by jobbing foundries is declining. Sales continue light, following fairly active contracting for the quarter. Orders for machine tool castings are unabated. Foundry coke specifications are spotty, with prices unchanged.

Toronto, Ont. — The melt is sustained at about 60 per cent, but with most melters covered for early needs, new business is slow. Spot sales average about 1000 tons weekly. While orders are reported down 50 per cent from a year ago, improved demand is looked for later this month.

Scrap

Scrap Prices, Page 90

Pittsburgh—With most of the outstanding tonnage on short sales covered and mills not inclined to place additional business, the market here is dead. Available scrap is light, but demand is even quieter, particularly since mills still owed scrap against old orders are retarding shipments. At the same time, distress tonnage is small and quotations generally are unchanged. No. 1 heavy melting steel continues $15.50 to $16.

Cleveland—Iron and steel scrap prices here, while for the most part unchanged, due to lack of actual tonnage sales, show evidences of weakness. This softness, while sentimentally evident currently, is expected to take quotational form following railroad list closings. New business is at a minimum as the trade continues to pursue a waiting attitude.

Chicago—The market tone is easier, and a number of grades are quoted lower. No. 1 heavy melting steel is nominal but unchanged at $14 to $14.50 on the basis of last mill purchases. Cast borings are down 50 cents, while springs, tires, short rails and angle bars also have been marked down.

Boston—Scrap prices are generally unchanged, both for domestic shipment and dock delivery for export with most activity confined to the latter. Demand by New England and Eastern Pennsylvania consumers is unusually light. Foundries in this district are buying in small lots from nearby sellers, while steel works, curtailing open hearth operations, are taking in little scrap.

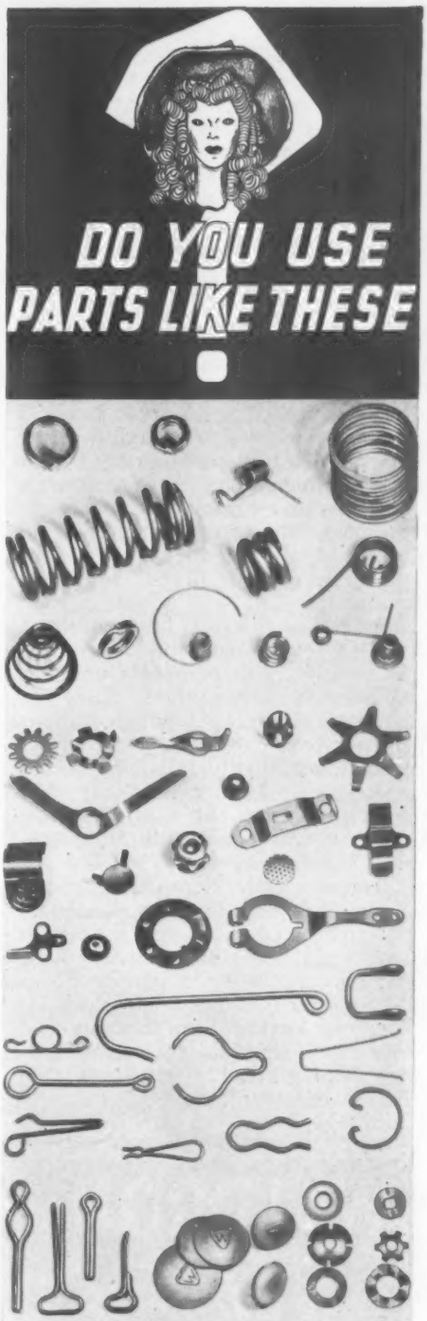
New York—Buying is light, with domestic prices for eastern Pennsylvania and nearby delivery unchanged. Mills are taking small shipments, generally against old orders, and movement of foundry grades also continues limited. Most activity is for export at unchanged prices. What buying was done by the cartel representatives here was more in the nature of an extension of old contracts and probably was under 75,000 tons.

Philadelphia—The market tone is slightly easier, but so far this is not reflected in lower prices. In fact, a sale of 3400 tons of compressed sheets at $14.54, f.o.b. plant, or $16.07 delivered, is indicative of the price situation. Brokers also are offering $15.50, Port Richmond, for No. 1 steel and $13.50 upward for No. 2 for export. Heavy breakable cast is weak and available at $15.

According to latest reports, the European cartel placed about 50,000 tons of scrap with various brokers at $13.50 for No. 2 and $15 for No. 1. In effect, the purchase amounted to an extension of the previous order placed at the same figures.

Other reports indicate the so-called extension of old export orders may have involved 150,000 tons. Many fail to understand why additional tonnage was sold at prices under levels at which old orders now are being covered. According to one explanation this loss is made up by sales of old compressed sheets and railroad scrap at more favorable prices.

Buffalo—The market is irregular but with no substantial sales to clarify prices. No. 1 heavy melting steel nominally continues $13.75



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to $14.25. Dealers refuse to accept lower bids on any large lots, while mills are equally adamant regarding prices. Shipments are limited, with one mill holding up all receipts.

Detroit—Scrap prices are easier here, reflecting uncertainty caused by spotty steel business, lagging car sales and the European situation. No. 2 heavy melting steel, flashings, bundles, stove plate and turnings have been marked down 25 to 50 cents. Bundled sheets are down to $11.50 to $12.

Cincinnati—Prices are down 50 cents on most grades, the weaker market being inspired partly by reduced steelmaking. Considerable covering of contracts has been done the past 30 days against immediate mill needs, and the market currently is without urgent consumer demand.

St. Louis—Scrap is in the quietest market experienced in a number of months, with prospects unfavorable for an early revival. Sales and inquiries are scant, and quotations have weakened on a number of grades, principally rails, sheets and specialties. Mills are taking shipments against old contracts, and with offerings smaller little distress scrap is accumulating.

Toronto, Ont.—Scrap trading continues dull despite some movement in such grades as heavy melting steel and machinery cast. Some dealers are piling scrap on docks for spring shipment, considerable tonnage having been accumulated recently. Receipts by local yards are gaining steadily and are well in excess of shipments.

Warehouse

Warehouse Prices, Page 89

Cleveland — Sales are fairly steady, the first week of April showing little change from the volume of late March. While recent business developments have affected the outlook unfavorably, some distributors look for a moderate upturn in demand later this month.

Chicago — Business has improved moderately so far this month, in line with expectations. Demand is coming from a broad list of consumers. Inquiries also are more active.

Philadelphia—Business is off to a slow start this month, with sales the first week considerably under March. However, last month was the best of the past 15. Some items, such as fencing and galvanized sheets, are seasonally more active.

Buffalo — Recent gains in sales have been largely seasonal. Structural products are moving less freely than usual for this period.

Cincinnati — Sales so far this month are maintaining the better pace attained in March. Steel needs for building purposes are slow to increase.

St. Louis — Warehouses have reduced prices on plates, shapes, sheets and bars from 15 to 35 cents per 100 pounds, the major cut applying to shapes and floor plates. This is reported to be purely a local situation and the result of severe competition from fabricators and other sources. Business is the quietest in a number of months.

Tin Plate

Tin Plate Prices, Page 86

Tin plate specifications are improved slightly, and although volume is below normal for this period, operations have moved up 2 points to 62 per cent. Movement of plate for sanitary can production continues relatively light, but increased demand is expected shortly.

Excess stocks of canned goods still restrict tin plate activity, and some trade leaders now are predicting a light food pack this summer. Specifications for beer containers are fairly good, and improvement is more apparent in some general lines. Export inquiry continues spotty.

Steel in Europe

Foreign Steel Prices, Page 89

London—(*By Cable*)—An addial blast furnace has been blown in to meet heavy demand for steelmaking iron in Great Britain. Foundry pig iron, however, is dull. Steelworks on the Northeast Coast are particularly active and production is increasing. The air ministry has placed a £1,000,000 aerodrome sheds contract. Works in the Midlands are active. The automobile trade is developing. Trade in tin plate has increased 100 per cent in the past three months.

The Continent reports export trade holding against adverse conditions. Markets in South America and the Far East show interest.

Bolts, Nuts, Rivets

Bolt, Nut, Rivet Prices, Page 87

What slight improvement has appeared in bolt, nut and rivet demand the past 30 days has been below expectations. Automotive needs still lag, but requirements of farm equipment builders are well maintained and some miscellaneous users are slightly more active. Ship specifications continue the principal sustaining factor in the East. Few new orders have appeared recently, but releases against old contracts are coming out freely. Prices generally are holding.

Refractories

Refractories Prices, Page 88

Pittsburgh — Silica brick prices for second quarter delivery have been raised $7.50 per thousand to $47.50 f.o.b. Pennsylvania and Birmingham, Ala., plants. This re-

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FRANCKE
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SPECIAL Types

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SALES REPRESENTATIVES IN PRINCIPAL CITIES

turns the price to the level of last December, when an equal decrease in price was made. Silica brick, f.o.b. Joliet and East Chicago, Ill., has been increased from $49 to $55.10. The price at these points was reduced from $56.05 to $49 in December, 1938. Other refractory prices have been reaffirmed for second quarter.

Iron Ore

Iron Ore Prices, Page 90

Cleveland — Little discussion is heard as yet regarding iron ore prices for the coming season. Inquiries still are awaited, with the start of shipments apparently about two weeks removed. April 20 is the current estimate of the probable date of the initial movement, although this figure is subject to vagaries of the weather. Ice continues outside Duluth harbor.

Chicago — Steamer JOSEPH BLOCK one of Inland Steel Co.'s ore freighters, left Manitowoc, Wis., April 1 for Port Inland, Mich., its first trip of the season. It will load limestone from Inland Lime & Stone Co.'s quarry and crushing plant and return to the steelworks at Indiana Harbor, Ind., being scheduled to arrive April 11. This is one of the earliest trips on record.

Nonferrous Metals

New York. — Tenseness in the European political situation continued to be the dominating influence in nonferrous metal markets last week. A slight recovery was recorded in London prices on Thursday prior to the holiday which will extend through Easter Monday. No substantial improvement in the markets is expected until foreign uncertainties clear.

Copper—The electrolytic market here was confused due to the existence of three prices. American Smelting & Refining Co. reduced prices ½-cent late Monday to 10.75c, Connecticut. All leading mine producers continued to quote 11.25c, the basis for drawn and rolled product prices. Interests in the outside market continued to quote variable prices for resale metal with the close quoted at 10.30c. Price reduction by the leading custom smelter was made in an effort to bring the domestic market in line with the world market and to stimulate buying. Consumer's supplies are at an all-time low and any wide move to replenish these stocks would absorb quickly, it is believed, offerings below the mine producers' price. The foreign market held up fairly well with prices ranging from 10.20c to 10.35c, c.i.f. European ports. Foreign sales improved whenever the market appeared stronger although Germany is finding it increasingly difficult to obtain tonnages here. Bookings here were well above the recent daily average. Red metal scrap and brass ingot prices moved lower.

Zinc—A slight recovery in London prices on Thursday relieved somewhat the pressure created by the threat of imports. Despite light new business the domestic market is

Nonferrous Metal Prices

Spot unless otherwise specified. Cents per pound.

April	Copper Electro, del. Conn.	Copper Lake, del. Midwest	Copper Casting, refinery	Straits Tin, New York Spot	Straits Tin, New York Futures	Lead N. Y.	Lead East St. L.	Zinc St. L.	Aluminum 99%	Antimony Amer. Spot, N.Y.	Nickel Cathodes
1	11.25	11.37½	10.17½	46.25	46.15	4.85	4.70	4.50	20.00	11.50	35.00
3	10.75	11.37½	10.22½	46.55	46.45	4.85	4.70	4.50	20.00	11.50	35.00
4	10.75	11.37½	10.00	46.20	46.15	4.85	4.70	4.50	20.00	11.50	35.00
5	10.75	11.37½	10.00	46.20	46.10	4.85	4.70	4.50	20.00	11.50	35.00
6	10.75	11.37½	10.00	46.15	46.15	4.85	4.70	4.50	20.00	11.50	35.00
7—Holiday.											

MILL PRODUCTS

F.o.b. mill base, cents per lb. except as specified. Copper brass products based on 11.25c Conn. copper

Sheets

Yellow brass (high)	17.31
Copper, hot rolled	19.37½
Lead, cut to jobbers	8.00
Zinc, 100 lb. base	9.75

Tubes

High yellow brass	20.06
Seamless copper	19.87½

Rods

High yellow brass	12.62
Copper, hot rolled	15.87½

Anodes

Copper, untrimmed	16.62½

Wire

Yellow brass (high)	17.56

OLD METALS

Nom. Del. Buying Prices

No. 1 Composition Red Brass

New York	6.00-6.25
Cleveland	6.75-7.00
Chicago	6.25-6.50
St. Louis	5.87½-6.12½

Heavy Copper and Wire

New York, No. 1	8.00-8.12½
Cleveland, No. 1	7.87½-8.12½
Chicago, No. 1	7.62½-7.87½
St. Louis	7.87½-8.12½

Composition Brass Borings

New York	5.25-5.50

Light Copper

New York	6.50-6.75
Cleveland	6.12½-6.37½
Chicago	6.25-6.50
St. Louis	6.12½-6.37½

Light Brass

Cleveland	3.75-4.00
Chicago	4.00-4.25
St. Louis	3.37½-3.62½

Lead

New York	4.10-4.35
Cleveland	3.50-3.75
Chicago	3.60-3.85
St. Louis	3.25-3.50

Zinc

New York	2.50-2.62½
Cleveland	2.00-2.25
St. Louis	2.00-2.25

Aluminum

Borings, Cleveland	6.25-6.50
Mixed, cast, Cleveland	7.75-8.00
Clips, soft, Cleveland	14.75-15.00
Mixed cast, St. Louis	7.75-8.25

SECONDARY METALS

Brass ingot, 85-5-5-5, less carloads	10.50
Standard No. 12 aluminum	12.50-13.00

Hollow Bored Forgings and Steel Shafting

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HYDRAULIC CYLINDERS
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fairly sound with shipments holding up at satisfactory pace and with stocks declining for the second successive month. Prime western held at 4.50c, East St. Louis.

Tin—Straits spot slipped to 46.15c at the close from the week's high of 46.55c. Moderate tonnages were booked on a few days but generally the market was quiet.

Lead—Due to the well covered positions of consumers, buying was light and confined to fill-in tonnages for immediate delivery. Prices held at 4.70c, East St. Louis.

Equipment

New York — Domestic machine tool orders are gaining, notably from shops connected with the aircraft industry. Buying by shipyards is also encouraging, heavy equipment business being active. The Fore River, Quincy, Mass., plant, Bethlehem Steel Co., has placed attractive orders, with other yards retooling for the construction of new and larger ships. The Springfield, Mass., armory, having placed scores of machines for the construction of a new automatic rifle, continues to inquire for machines, notably millers. In addition, miscellaneous buying is sustained, buyers closing on considerable equipment pending for some time.

Chicago—First week of April has started off at a good pace, with possibility that business for the month as a whole may come close to March volume, which for some interests was reported best since July, 1937. Road machinery interests are prominent buyers at this time, being in good season and with rush orders noticeable. Agricultural requirements are consistent, but at present railroad buying is rather light. Inquiries continue in good volume but some spottiness in tone is detected.

Cleveland—Resistance to closing on business already figured is noted here by some dealers, although a large amount of business remains active. Builders' activity generally is fair, although dealers express uncertainty about the immediate future. Whether the increase in domestic orders of the past few months continues through the spring depends largely on foreign developments, they believe. Monarch Machine Tool Co., Sidney, O., recently was awarded contract for more than $65,000 for lathes by the government. Cleveland Graphite Bronze Co. last week submitted to stockholders a proposal for a $2,000,000 building and expansion program.

Construction and Enterprise

Ohio

ASHLAND, O.—City, W. A. Mason, mayor, will start survey in projected construction of water softening plant to cost $25,000, and additional capacity of water reservoir. Consulting engineer, E. D. Barstow, Akron, O. (Noted March 20.)

ASHLAND, O.—City, W. A. Mason, mayor, takes bids due at noon, April 22, on construction of a sewage disposal plant costing about $157,000, and including primary settling tanks, motor-driven rotary distributors, secondary tanks, chemical treating equipment, incinerator, and miscellaneous equipment. Certified check or bid bond 5 per cent to accompany bid. E. D. Barstow, Akron, O., consulting engineer. (Noted March 27.)

CINCINNATI—Cincinnati Milling Machine Co. has plans for constructing a 400,000-square foot plant here.

CLEVELAND — Cleveland Graphite Bronze Co., Benjamin F. Hopkins, president, has tentative plans for inaugurating a plant expansion program amounting to $2,000,000.

LIMA, O.—Ohio Steel Foundry Co. is preparing to move its machine shop here from Springfield, O., and to build a new roll turning plant. Entire program will cost about $200,000.

MONTPELIER, O. — Village, J. M. Hoover, superintendent of utilities, is taking bids due at noon, April 26, on contract 2 in the construction of a water softening and filtration plant costing $75,000. Involves water softener, mixing and settling tanks, clear well, gravity filters and chemical feed equipment. Consulting engineer, H. P. Jones Co., Toledo, O. (Noted March 6.)

NEW STRAITSVILLE, O. — Village, John S. Wilson, clerk, will probably soon take bids for construction of a proposed waterworks costing $60,000. WPA funds allotted.

SPRINGFIELD, O.—City, W. H. Story, manager, is preparing plans and will soon advertise for bids on contract 2 in construction of a dam and waterworks costing total of $1,091,580. Contract involves filter plant and equipment amounting to $400,000. Alvord, Burdick & Howson, Chicago, consulting engineers.

TORONTO, O.—Ohio Edison Co., Mr. Funk, chief engineer, Akron, O., is completing plans and will accept bids at once in the construction of a 52-foot addition to its power plant at cost of about $3,500,000. Engineer in charge, J. H. Foote, chief engineer, Commonwealth & Southern Corp., Jackson, Mich. (Noted March 20.)

Massachusetts

FITCHBURG, MASS.—Harry Doehla Co. rejected first bids and will readvertise in a project to construct a two-story, 60 x 72-foot factory addition costing $40,000. J. S. Bilzerian, Worcester, Mass., architect. (Noted March 20.)

New Hampshire

NEW LONDON, N. H.—City sewer commission, H. Swift, chairman, proposes to construct a sewage disposal plant costing $46,100. F. A. Barbour, Boston, consulting engineer.

Rhode Island

GREENVILLE, R. I.—Greenville Finishing Co. Inc. is taking bids on construction of a $40,000 addition to its boiler plant. Will install sprinkler system. C. R. Makepeace & Co., Providence, R. I., architects.

New York

AMSTERDAM, N. Y.—City aldermen plan to build a sewage disposal plant at cost of $250,000 to end river pollution. Mayor A. Carter has charge.

BINGHAMTON, N. Y. — Agfa Ansco Corp. has purchased a six-acre tract adjoining its plant and will build an addition costing $40,000. Engineer, care of owner.

NEW YORK—Pneumatic Tool, Sales & Repair Co. Inc., Queens, has been incorporated with capital of $14,000 to make and sell tools, air compressors and drills. Milton Eisen, 342 Madison avenue, New York, is representative.

NORWICH, N. Y.—City, common council, has plans, for maturity soon, to construct a sewage disposal plant at cost of more than $50,000. S. Johnson, city engineer.

SOUTH FALLSBURGH, N. Y. — City water district will take bids due about May 1 in the construction of a water supply system costing about $120,000. Alexander Potter, New York, consulting engineer.

New Jersey

LINDEN, N. J. — Simmons Co. has awarded contract for building a factory addition estimated to cost $80,000 to Brown & Matthews Inc., 122 East Forty-second street, New York.

Michigan

STURGIS, MICH.—City, S. F. Weatherwax, clerk, takes bids until April 12 for two outside transformer stations, bus structure for diesel power plant and metal clad switchgear for water power plant. Part of $275,000 PWA project, Ayres, Lewis, Norris & May, Ann Arbor, Mich., consulting engineers.

Illinois

SHELBYVILLE, ILL.—Shelby Electric co-operative, L. Boys, project superintendent, is receiving bids on construction of about 217 miles of rural electric power transmitting lines costing $248,000. REA has allotted a loan. Young & Stanley Inc., Muscatine, Iowa, consultant.

STERLING, ILL.—Northwestern Steel & Wire Co., J. C. Foster, president, has awarded contract for reconstructing four units of its plant which were recently destroyed by fire to P. Horman, Sterling. Cost estimated at $200,000.

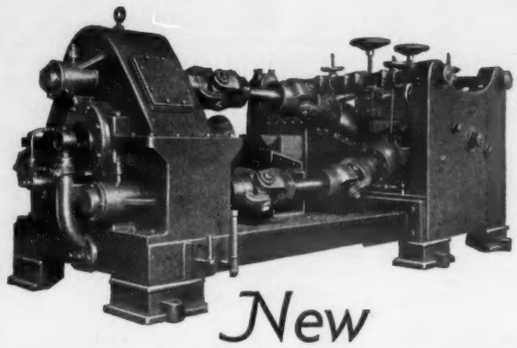
WOOD RIVER, ILL. — Shell Oil Co. Inc., St. Louis, will soon let contracts for constructing a one-story, 40 x 140-foot warehouse addition at its oil refinery here.

Indiana

ELKHART, IND.—Elkhart Trailer Supply Co. Inc., 322 Harrison street, has been incorporated with capital of $10,000 to manufacture metal parts for house trailers. Organizers: W. A. Harris, Grant Mates and Edith Harris.

Alabama

MOBILE, ALA.—Mobile & Ohio rail-



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road, H. Austill, chief engineer, St. Louis, proposes to build a warehouse and docks costing total of $200,000.

PRATTVILLE, ALA.—Central Alabama Electric Membership Corp., Maury McWilliams, president, has received $380,000 REA allotment for constructing 455 miles of rural electric power distributing lines in three counties.

Maryland

BALTIMORE—Charles T. Brandt Inc. has awarded contract to George S. Awalt & Co., 718 Hunting place, for construction of a sheet metal shop costing $20,000. Structure to be one-story, 124 x 250 feet. Lucius R. White Jr., Baltimore, architect.

District of Columbia

WASHINGTON — Navy department, yards and docks, proposes to purchase a turbo-alternator, condenser, air ejector, and condensate pump for installation at the Newport, R. I., naval torpedo station. Specification 9108.

WASHINGTON — Navy department, bureau of supplies and accounts, receives bids until 10 a.m., April 11, on testing generators (schedule 5921); and until April 14 on electric windlasses (schedule 5918), motor-driven plate punch machine (schedule 5962), pelleting machine (schedule 5963), plate shear and turntable machine (schedule 5972), and motor-driven surface grinder (schedule 5973).

Kentucky

DANVILLE, KY.—City, board of councilmen, plans to build a sewage disposal plant and incinerator costing total of $100,000. H. W. Taylor, New York, consulting engineer.

Florida

CLEARWATER, FLA.—City, F. L. Hendrix, city manager, is receiving bids for constructing a sewage disposal plant, sewage pumping stations and force mains. Wiedeman & Singleton, Atlanta, Ga., consulting engineers.

Georgia

DECATUR, GA.—City plans to construct a water supply system costing $2,000,000. Roberts & Co., Atlanta, Ga., consulting engineers.

North Carolina

ELKIN, N. C.—Chatham Mfg. Co., T. Chatham, president, has plans for constructing a plant addition comprising 145,000 square feet and costing $500,000. Will mature May 1.

GREENVILLE, N. C.—Water and light commission, M. Swartz, superintendent, plans to build 101 miles of rural electric lines at cost of $80,000. H. L. Rivers, town engineer.

HALIFAX, N. C.—Roanoke Electrification Membership Corp. has received a $62,000 REA allotment for constructing 62 miles of rural power transmission lines. W. W. Corcoran, Halifax, consultant.

HIGH POINT, N. C.—City council has authorized issue of bonds not to exceed $4,000,000 to finance proposed municipal hydro-electric power project estimated to cost $6,492,000. (Noted Jan. 2.)

LA GRANGE, N. C.—City, C. G. Robson, mayor, votes April 18 on proposal for issuing $220,000 bonds to acquire and improve electric power and water systems.

South Carolina

ABBEVILLE, S. C.—City, J. A. Long, mayor, receives bids April 28 for constructing a dam and power house with complete equipment. Wiedeman & Singleton, Atlanta, Ga., engineers.

UNION, S. C.—WPA has approved $35,000 allotment to city for construction of a sewage disposal plant and extension of sewage collecting system.

West Virginia

WEIRTON HEIGHTS, W. VA.—City, Carl Frankovitch, solicitor, has completed survey in the proposed construction of a sewage disposal system costing approximately $50,000. Norman Parsons, Weirton Heights, Hancock county sanitary engineer.

Missouri

ELDORADO SPRINGS, MO.—City, C. H. Sunderworth, mayor, has completed plans and will set date soon for closing bids on construction of a diesel generating plant and distributing system. W. B. Rollins & Co., Kansas City, Mo., consulting engineers.

Wisconsin

DE PERE, WIS.—Duncan Equipment Co. has been organized here to manufacture metal and wood kitchen cabinets and sinks. A. E. Meyer, De Pere, is factory manager and treasurer.

LACROSSE, WIS.—Trane Co. has let general contract for erecting a one-story, 80 x 260-foot brick and steel factory addition to Austin Co., Chicago.

MILWAUKEE—Acme Galvanizing Inc., I. M. Herrmann, president, has purchased factory buildings and will equip 17,500 square feet for galvanizing, solder dipping, cadmium plating and chrome plating. Operations scheduled to begin May 1.

Minnesota

MABEL, MINN.—Village, W. I. Munson, clerk, takes bids until 7:30 p.m., April 18, on the construction of a sewage treatment plant. Certified check 10 per cent to accompany bid. Herman Hagestad, River Falls, Wis., consulting engineer.

Texas

AUSTIN, TEX.—Lower Colorado river authority, F. Englehard, chairman, is taking bids to April 28 for turbines, governors and generators for power plant at Marshall Ford project.

HOUSTON, TEX. — Southline Metal Products Inc. has been incorporated with capital of $19,000 to make mining and manufacturing equipment. Organizers: Harold Verson, Elizabeth Verson and Elliott Roberts, all of Houston.

SAN ANTONIO, TEX.—Guadalupe Valley Co-operative Inc., M. D. Linderman, president, has been allotted $157,000 by REA for erecting rural electric power lines totaling 198 miles in four counties.

Kansas

KANSAS CITY, KANS.—City is taking bids to April 12 on a motor-driven centrifugal pump for its new pumphouse costing total of $350,000. Burns & McDonnell Engineering Co., Kansas City, Mo., engineer.

North Dakota

WHITMAN, N. DAK.—REA has allotted $108,000 to the Five Star Rural Electric co-operative, F. C. Chandler, president, to finance construction of 100 miles rural electric lines through four counties.

Nebraska

HARTINGTON, NEBR. — Cedar-Knox Rural Public Power district has approval of state railway commission to construct 178 miles of rural electric power lines. H. H. Henningsen Engineering Co., Omaha, Nebr., consulting engineer.

Iowa

POSTVILLE, IOWA—REA has allotted $214,000 loan to the Allamakee-Clayton Electric co-operative, Joel Clark, president, to finance construction of 206 miles of rural transmission lines to serve consumers in three counties.

SAC CITY, IOWA—Sac County Rural Electric co-operative, D. W. Meyer, president, to finance the construction of 157 miles of rural transmission lines serving 344 consumers.

SIBLEY, IOWA—Village, R. D. Stewart, clerk, is receiving bids until 10 a.m., April 26, on installing boiler, stoker, controls, heaters, pumps, water softener, switchgear and other equipment in municipal plant. Certified check 5 per cent to accompany bid. Young & Stanley, Muscatine, Iowa, consulting engineers.

WAVERLY, IOWA—Iowa Public Service Co., A. E. Rathkey, gas superintendent, Waterloo, Iowa, will construct a gas plant costing $20,000, and including air compressors, steel pro-pane storage tank and pro-pane gas mixing equipment.

Wyoming

ROCK SPRINGS, WYO.—Union Pacific Coal Co., Eugene McAuliffe, president, plans installing two additional boilers and new 7500-kilowatt turbo-generator in its power plant.

Idaho

ASTON, IDAHO — REA has allotted $80,000 loan to Fall River Rural Electrification Corp. to finance projected construction of 62 miles of rural electric power transmitting lines.

BELLEVUE, IDAHO—City proposes to install a new water system at total estimated cost of about $55,000. H. W. Merritt, Twin Falls, Idaho, consulting engineer.

MOSCOW, IDAHO—University of Idaho regents have retained consulting engineer Lincoln Bouillon, Seattle, to prepare plans for a proposed boiler unit in the central heating plant, for which $90,000 is available. Will receive bids in about 60 days.

Pacific Coast

LOS ANGELES—Western Washer & Stamping Co., 2111 East 51st street, has permit for constructing an addition to its plant.

SAN FRANCISCO — S.K.F. Industries Inc. has awarded contract to Cahill Bros., 206 Sansome street, for constructing a one-story warehouse costing $40,000. W. D. Peugh, San Francisco, architect.

NEWPORT, WASH.—City proposes to build a sewage system and disposal plant at total cost of approximately $56,000. H. A. Sewell, Newport, engineer.

READER *Comments*

Readers are invited to comment upon articles, editorials, reports, prices or other editorial material appearing in STEEL. The editors cannot publish unsigned communications, but at their discretion may permit a writer to use a pseudonym when a bona fide reason exists for withholding his identity. Letters should be brief—preferably not exceeding 250 words.

Finding Jobs for Plus 40's

To the Editor:

You and your readers may be interested in a new organization, "Forty Plus of Northern Ohio," whose aim is to re-establish in industry executives over 40 years old who have been displaced by business conditions. It is a co-operative club seeking to show employers that it is advantageous to eliminate arbitrary age deadlines discriminating against men over 40; to demonstrate that this type of man, with a creditable business achievement record, is a valuable and economic asset to any organization.

Membership is composed of executives whose records of business ability and experience demonstrate definitely that they are capable of filling responsible positions which merit suitable compensation. No membership dues or placement charges are required. Each applicant submits a complete business record before action can be taken on his application.

Thus the organization constitutes a pool of available executives, now unemployed, with full information as to experience and ability of each. A marketing committee makes contact with the employer and recommends such club members as would fit the specifications of the job. No member needs to try to sell himself. The selling is done on a business basis by the committee. When placed in a position a member's connection with the club is severed.

An unemployed executive unable to place himself soon loses morale and it is surprising how quickly he regains it when associated with this organization, contact with others in like position, and a chance to get another job stiffening his backbone anew.

Ohio unemployment commission has welcomed this opportunity to co-operate with unemployed executives, as it offers opportunity to find men suited to fill applications for which no source had existed.

In the few weeks since our organization we have placed nearly a dozen executives who had been unemployed for varying periods since the depth of the depression separated them from their jobs, with profit to them and to the employers who had sought their services.

Headquarters are at 897 Union Commerce building, Cleveland. We welcome applications from any persons qualified and from employers in need of high class services. As the club's existence and aims become better known we believe both classes will be benefitted by the co-operative effort we are putting forth.

L. C. HOFFMAN

Cleveland Heights, O.

Serious Problem, Well Handled

To the Editor:

Let me congratulate you on the article on leveling employment in the steel industry. (STEEL, April 10, p. 15.) It is a splendid presentation of a serious problem and the suggestion you have made for relieving it to some extent should result in a general discussion between steel producers and consumers.

You have done so well with the suggestion that I have nothing further to offer.

STEEL BUYER

New York

Is Passing it Along

To the Editor:

I have found your article on "Pride in Craftmanship" (STEEL, March 27, p. 40) very interesting. I am passing it around to several in our organization whom I know would like to read it.

CLAYTON R. BURT

President and General Manager,
Pratt & Whitney,
Hartford, Conn.

Fosters Spirit of Pride

To the Editor:

We were pleased with the way you handled the article, "Pride in Craftmanship" (STEEL, March 27, p. 40) and we realize you must have recognized the existence of the spirit throughout our society.

We know there is a spirit which exists among men in this work and we believe it is the most valuable thing we have and we continue to foster it as a society. We believe it is responsible for much of the success of our various undertakings.

FORD R. LAMB

Executive Secretary,
American Society of Tool Engineers,
Detroit

Has Leveled Its Employment

To the Editor:

While every phase of the steel industry has its own problems we and several other companies are and have been for years doing what you suggest in your article on leveling employment. (STEEL, April 10, p. 15.) Some producers cannot do this and we cannot in the case of many products.

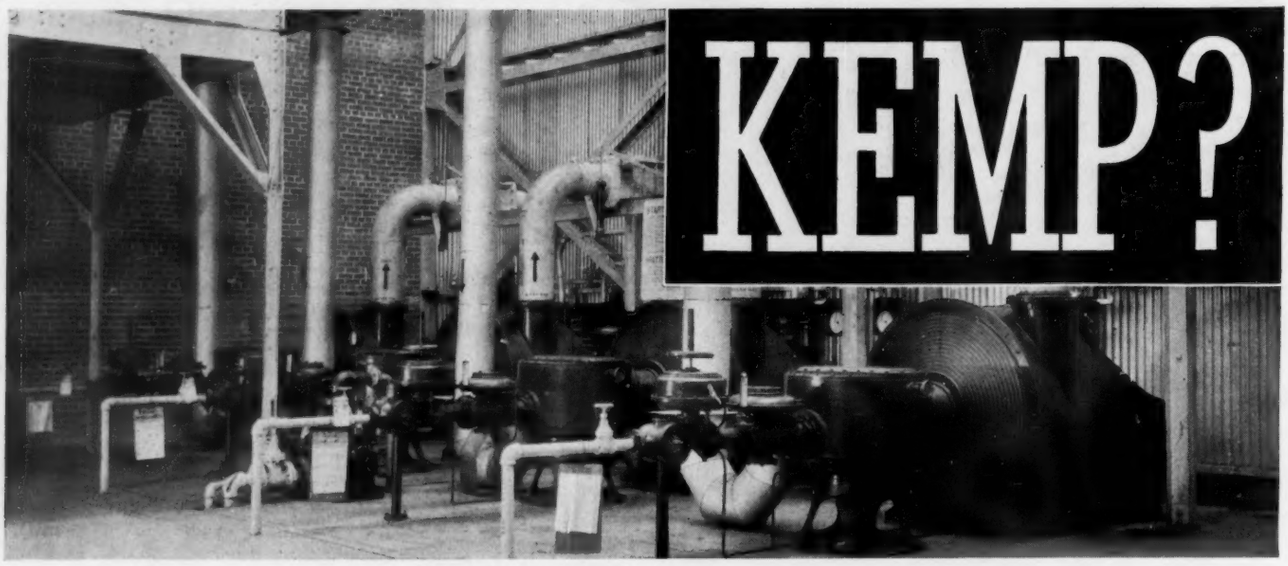
STEELMAKER

Pittsburgh

WHY

Are ALL New Modern

Tin Mills Equipped by



KEMP?

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1. Increased production is given where tin pots are Kemp equipped. No crew and no machine can out-step hot metal.

2. Improved quality may be expected through tin and palm oil temperature regulation, giving the closest control ever secured.

3. Detailed production records credit Kemp with 40% saving in fuel. Heat is applied inside the metal not outside the pot.

4. Kemp gives material dross reduction, which will pay phenomenal returns on required investment.

For further details address The **C. M. Kemp Manufacturing Co., Baltimore, Md., or Oliver Building, Pittsburgh, Pa.**

KEMP of BALTIMORE